EXHIBIT 2

TECHNICAL SPECIFICATIONS

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SECTION 01001

SUMMARY OF WORK

PART 1 – GENERAL

1.01 SCOPE

A. The Work to be performed under this Contract shall consist of furnishing plants, tools, equipment, materials, supplies, and manufactured articles and furnishing labor, transportation, and services, including fuel, power, water, and essential communications, and performing work, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents.

B. This project consists of furnishing and installing all materials and products in the Norris Reserve Lift Station Force Main Re-Route Project. Components included are; approximately 3,380 lineal feet of 8”-diameter ductile iron force main in trenches from an existing force main on Dennis Springs Road to SR 124, and again from SR 124 to Stonebridge Park Circle to an existing manhole, 5,220 lineal feet of 8”-diameter high density polyethylene force main installed within a 24”-diameter abandoned ductile iron force main along SR 124, installation of 8”-diameter force main across the Yellow River, access manholes, air/vacuum release valves, clearing, grubbing, restoration, and all ancillary improvements.

C. The quantities shown on the bid form are estimates for the Work, including the intended construction method based upon the available information. The assigned means, methods, and quantities described herein are subject to revision by the **County** for various reasons including but not limited to, unforeseen utility conflicts/ground water, discovery of subsurface rock strata, unforeseen pipeline encasement, etc. As such, a unit price contract type has been selected to execute the Work and is not intended to be a guarantee for a minimum amount of work.

1.02 PROJECT LOCATION

The Work is required at the locations shown on the Approved Drawings.

1.03 WORK COVERED BY THE CONTRACT DOCUMENTS

Work shall be performed according to the requirements of the Contract Documents.

1.04 WORK COORDINATION

A. The **Contractor** shall coordinate the Work with third parties (such as public utilities and the telephone company) in areas where such parties may have rights to underground property or facilities; and request maps or other descriptive information as to the nature and location of such underground facilities or property.

B. The **Contractor** shall coordinate the Work with owners of private and public property where access is required for the performance of the Work.

C. The **County** will work with the **Contractor** to assign and schedule the Work in a logical and efficient format. However, the items in this contract shall be priced such that each item may be assigned independently or combined with other items at the **County**'s sole discretion in regard to both quantity and scope. The **Contractor** shall perform only those work items directed by the **County** at the prices specified herein. (For example, if the **County** determines that a line segment shall be cleaned but not televised, the same unit price for cleaning shall apply.)

1.05 CONDITIONS AT THE SITES

A. The **Contractor** shall make necessary investigations to determine the existence and location of underground utilities.

B. The **Contractor** shall be responsible for damage to and for maintenance and protection of existing utilities, structures, and personal property.

C. These Contract Documents do not guarantee such utilities are in the location indicated or that they actually exist, or that other utilities are not within the area of the operations.

D. The **Contractor** is responsible for safety at no additional cost to the **County**.

E. The **Contractor** shall report hazardous conditions to the **County**.

END OF SECTION

SECTION 01010

PROJECT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

Section includes:

A. Lands and Rights-of-Way/Easements, and Permits

B. Access to and **Contractor's** use of the site

C. Coordination requirements

D. Construction procedures

1.02 LANDS AND RIGHTS-OF-WAY: EASEMENTS AND PERMITS

A. Access to the Work shall be limited to the right-of-way or easement area provided for execution of the Work. The **Contractor** shall not enter any adjacent private property without prior written approval from the property owner. Proof of such approval shall be furnished to the **County** upon request. If the **Contractor** deems additional permitting and access are required then they shall be obtained by the **Contractor** and the **Contractor** shall bear the cost.

B. If the **Contractor** performs any work or service for any property owner outside the specified scope of the **Contractor's** agreement with the **County** or has any agreements with a private property owner for access to or for temporary use of property outside of the right-of-way or easement area, a written agreement shall be entered into with the private property owner(s) prior to any work or service being performed or prior to any use by **Contractor** of the private property and such agreement shall be provided to the **County**. The agreement shall contain the following language, in addition to the terms agreed to between the **Contractor** and the property owner:

"The Property Owner understands that DeKalb County is not a party to this Agreement, exercises no control over the means, methods, and execution of this agreement, and that DeKalb County assumes no responsibility for the Contractor's compliance with the terms of this agreement. The Contractor shall be solely liable for any and all claims, demands, and judgments related to loss or damage to property or person (including death) arising from or in any way related to the Contractor's acts or omissions related to the agreement."

1.03 ACCESS TO AND CONTRACTOR'S USE OF THE SITE

A. The space available to the **Contractor** for the performance of the Work, either exclusively or in conjunction with others performing other construction as part of the project, is shown on the drawings.

B. The **County** shall continue to utilize the existing wastewater collection system and water system during assessment and construction.
   1. The **County** will endeavor to cooperate with the **Contractor's** operations when the **Contractor** has notified the **County** in advance of need for changes in operations in order to accommodate construction operations.

   2. The **Contractor** shall conduct the Work to cause the least interference with the **County's** operations.

C. Equipment and vehicles used by the **Contractor** on the project shall be marked with the **Contractor's** name and telephone number.

1.04 COORDINATION REQUIREMENTS

A. Coordination with **County**:

   1. Limit access through occupied areas to those days and times the **County** approves. Occupied areas include areas in which the **County's** regular operations will be going on or to which the **County** requires access during the construction period.

   2. When the following must be modified, provide alternate facilities acceptable to the **County**:

      a) Emergency means of egress
      b) Utilities that must remain in operation
      c) Informational signage

   3. The **Contractor** shall notify the **County** immediately of any circumstances that may jeopardize or that have interrupted utility service.

B. Security Procedures:

   1. Limit access to the site to persons involved in the work.

   2. Provide secure storage for materials.

   3. Secure completed work as required to prevent loss.

C. Coordination of Construction:

   1. Inform each party involved, in writing, of procedures required for coordination of the Work; include requirements for giving notice, submitting reports, and attending meetings.

   2. Inform the **County** in advance, with ample time, when coordination of Work is required.

D. Utilities Notification Prior to Construction:

   1. Georgia law mandates that, before beginning mechanical digging or excavation work, **Contractor** shall contact Georgia 811 by using eRequest on www.Georgia811.com or by calling 811 or 1-800-282-7411.

2. **Contractor** may utilize EDEN (Excavation Digging Event Notification) web application that enables Members and Professional Excavators to create, manage, respond to, and edit Georgia 811 Locate Request Tickets.

3. **Contractor** shall retain records of notification and responses during the course of the project until final Payment.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. General Examination Requirements:
   1. Prior to performing work, examine the applicable substrates and the conditions under which the work is to be performed.

   2. If unsafe or otherwise unsatisfactory conditions are encountered, take corrective action before proceeding.

   3. Notify the **County** promptly of type modifications required.

   4. Before starting work that might affect existing construction, verify the existence and location of underground utilities and other underground construction.

   5. Prepare preconstruction photographic documentation in conformance with the requirements of **Section 01380 - Photographic Documentation** of these specifications.

B. General Preparation Requirements:
   1. The **Contractor** shall obtain, maintain, and pay for required permits.

   2. The **Contractor** shall take field measurements as required to properly conduct the work.

C. Cleaning and Protection: Keep installed work clean, and clean again when soiled by other operations.

D. Final Cleaning:
   1. Remove materials and equipment that are not part of the work and any debris from the site prior to substantial completion.

   2. Dispose of debris in a lawful manner.

   3. Perform final cleaning after substantial completion has been certified, but before final payment.

   4. Clean entire project site and grounds.

E. Substantial Completion:

1. Requirements for the **Contractor** achieving Substantial Completion are defined in the Contract Documents in GR-1 of the General Requirements.

2. Substantial Completion is typically defined to include:

   a. Completion of Work required by the Contract Documents

   b. Operation of components and systems of the Work, including acceptance of testing and startup requirements

   c. Closeout of quality deficiencies and non-conformances

   d. Delivery and acceptance of spare parts, operations manuals, and vendor documentation

   e. Completion of vendor training

   f. Completion and delivery of "red-line" as built drawings as well as electronic files in approved format. **Contractor** to provide survey for record drawings. Survey shall include horizontal coordinates referenced to NAD 1983 (2011) and elevations referenced to NAVD 1988 Georgia State Plane Coordinate System.

3. When the **Contractor** believes substantial completion has been achieved, **Contractor** shall notify the **County** in writing, requesting Substantial Completion. The **County** will verify that the contractual documentation requirements for Substantial Completion have been completed, including closeout of open NCRs. If verified, the **County** will schedule a Substantial Completion inspection and walk-through with the **Contracto**r, DWM Operations, and the Designer, or will notify the **Contractor** in writing of acceptance or the reason(s) for denying Substantial Completion.

F. Final Completion:

1. Requirements for the **Contractor** achieving Final Completion are defined in the Contract Documents in GR-9 of the General Requirements.

2. After Substantial Completion, **Contractor** shall meet additional requirements for Final Completion and release of final payment. These requirements will be defined in the Contract and typically include:

   a. Completion of punch list items by the **Contractor**

   b. Demobilization from the project site

   c. Submittal of warranties

   d. Release of subcontractor or vendor liens

e. Turnover of remaining project documents required by the Contract, including final as-built drawings by the **Contractor**

3.02 CHANGE MANAGEMENT

A. Contract Change Process

Any firm under contract with the **County** may submit a Change Request (CR) to the **County** following the requirements of the contract. A CR may address requested changes in cost and/or schedule, as well as contract terms or scope that do not result in cost or schedule impacts.

Changes may also be initiated by the **County** in the form of a Field Order (FO). The **Contractor** shall proceed with the change unless they believe the FO entitles them to a change in contract price, time, and/or term. If so, the **Contractor** shall submit a CR within 15 days of receiving the FO.

The CR from the **Contractor** is to be accompanied by a detailed proposal describing the **Contractor**'s opinion of the CR's cost, schedule, and/or contract term impacts.

If the CR is acceptable to the **County**, the **Contractor** will be directed to submit a CO to the **County** to process. If the CR is not acceptable to the **County** then the **Contractor** may negotiate the CR. If the cost and/or schedule impacts cannot be agreed, then the **County** will either instruct the **Contractor** to proceed with the change using a Unilateral Change Directive (UCD), if the change is deemed by the **County** to be needed, or the change can be terminated if the change is deemed to be not needed. If the **County** issues a UCD after failing to agree on the price of a CO, then the pricing of the change is per the contract terms.

A UCD can be initiated by the **County** only when there is an imminent threat to public safety or health, or a potential shutdown of a vital **County** function.

B. Amendment to the Contract

If the approval of a CO requires a written, formal amendment to the contract, the **County** will process the formal amendment.

C. Project Scope Change Impacts

A change to a Design /Build contract may materially change the scope of the project, including greater impact on the construction scope than the design scope. A design scope change may also materially impact the project configuration even if it is a no-cost change. Additionally, a change to one project's scope may have impacts to another project's scope.

So that a CO is not approved without understanding its full impacts beyond the affected contract scope, project scope change impacts shall be approved by the **County**. These must consider changes through every phase of the project, and/or impacts to other projects.

D. Baseline

If a CO is approved, the **Contractor** will prepare a Project Baseline Change Instruction Form to formally change the project scope, baseline schedule, and baseline budget.

E. Change Monitoring
The **Contractor** is responsible for monitoring changes to the contract. The **Contractor** will maintain a Design Change Log for each project, and will maintain a Construction Change Log that includes the change description, change status, category of change, contract, estimate of cost, estimate of schedule impact, and current process step. Change logs are updated each month and included with the Project Progress Report.

Responding to and processing changes in a timely manner is a priority. Change backlogs will be vigorously monitored and managed. Change status reports will be developed by the **Contractor** from the Change Logs to provide current status of each open change, which process step is active, and how many days remain in the process step. "Overdue" reports will be elevated to the **County** for follow-up and closure.

F. Change Status
Changes will be identified by one of the four following status descriptions:

Proposed Change is a change that has been submitted as a CR or FO, but has not yet been negotiated. Proposed changes require closure if they are deemed to be not required, or must be resolved in a timely manner if they are deemed required. The cost estimate and/or schedule impact of a proposed change will usually change as it goes through the contract change process. These changes must be reflected in the Change Log as they occur and included in monthly cost and schedule forecasts.

Pending Change is a change that has been negotiated, but has not yet received final **County** approval. These changes must be included in monthly cost and schedule forecasts.

Approved Change is a change that has received final **County** approval. The contract scope, budget, and/or schedule will be amended to include approved changes. Approved changes will be included in monthly cost and schedule forecasts until a formal re-baselining of the project schedule and/or budget is approved.

Closed Change is a change that has been formally rejected and closed by the **County**, or withdrawn by the originator.

G. Category of Change
Changes will be categorized as follows to track the types of changes that occur over the life of the project:

- **County** Requests: any change initiated by the **County**.
- Differing Site Conditions: new information not reasonably available during design, or considered "unforeseeable" through due diligence on the part of the **Contractor**.

- Design Errors: changes due to errors or deficiencies in the design.
- Design Omissions: items omitted from the design that would have been included in the original bid, had they been known.
- Regulatory Requirements: changes mandated by regulatory agencies that are different from approved permit conditions at the time the contract was approved.
- Other: changes required for all other reasons, including emergency work, adjustment of bid quantities, force majeure events, incentive payments, accepted substitutions, and changes identified during value engineering.

3.03 HEALTH AND SAFETY CONSIDERATIONS

A. Take precautions to prevent fires and to facilitate firefighting operations.

B. Take precautions to prevent accidents due to physical hazards.

C. Maintain working conditions in order to keep the site and adjacent public ways free of hazardous and unsanitary conditions and public nuisances.

D. Maintain working conditions to control rodents and other pests; prevent infestation of adjacent sites and buildings due to pests on this site.

E. Keep public streets free of debris from this Work.

F. Provide adequate traffic control in accordance with current MUTCD standards and the approved traffic permit.

G. When using trenches/excavations, follow OSHA standards 29 CFR 1926.650, 29CFR 1926.651, and 29 CFR 1926.652.

3.04 ENVIRONMENTAL PROTECTION

A. General

Contractor shall conduct its operation in a manner to prevent pollution of the environment surrounding the area of work and shall be responsible for furnishing necessary items for fulfilling the work described herein.

B. Material Transport

Contractor shall comply with the Official Code County of DeKalb Georgia pertaining to the duties of the **Contractor** in hauling material over **County**-owned rights-of-way. This includes, but is not limited to, approval of proposed haul routes, prevention of dropping of materials or debris on the streets from trucks arriving and leaving the site, providing a suitable vehicle inspection and cleaning installation with permanent crew, and the removal of material spilled in public areas at no additional cost to the local government agency.

C. Waste Materials

No waste or erosion materials shall enter natural or manmade water, wastewater collection systems, or stormwater drains. Erosion materials from excavations, borrow areas, or stockpiled fill shall be contained within the work area. **Contractor** shall develop methods for control of waste and erosion, which shall include filtration, settlement, and manual removal to satisfy the above requirements.

D. Burning

No burning of waste shall be allowed.

E. Dust Control

The **Contractor** shall control the generation of dust by its operations. Control of dust shall be accomplished by water sprinkling or by other methods approved by the County.

F. Noise Control

The **Contractor** shall minimize the noise caused by its operations.

When required by agencies having jurisdiction, noise-producing work shall be performed in less sensitive hours of the day or week as directed by the **County**.

The **Contractor** shall provide equipment that operates with the least possible noise. The use of noisy equipment is prohibited. Hoists and compressor plants shall be electrically operated unless otherwise permitted. The air intake of compressors shall be equipped with silencers, and machinery operated by gearing shall be provided with a type of gearing designed to reduce noise. Internal combustion engines shall be equipped with mufflers in good order.

Noise generated by mobile construction equipment, stationary construction equipment, and other equipment involved in the construction of the Work shall not exceed the decibel levels indicated below. Noise generated by mobile and stationary construction equipment will be measured 3 to 6 feet from building lines, and on the A-weighting network of Type 2 general purpose sound level meter set at fast response.

	Combined Residential and Commercial
Allowable sound levels of mobile construction equipment:	
▪ From 7 a.m. to 10 p.m., Monday thru Saturday, except legal holidays	85 dBA
▪ At times other than those listed above	70 dBA

	Combined Residential and Commercial
Allowable sound levels of stationary construction equipment: ▪ From 7 a.m. to 10 p.m., Monday thru Saturday, except legal holidays	70 dBA
▪ At times other than those noted above	60 dBA
Night work from 10 p.m. until 7 a.m. shall require an approved special permit from the **County**.	The dBA level will be included in the approved permit.

G. Use of Chemicals

Chemicals used during construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, shall show approval of either EPA or FDA. Use of such chemicals and disposal of residues shall be in conformance with instructions.

H. Bypassing During Construction

No wastewater shall be bypassed at sewage collection or treatment facilities during project construction unless a bypassing schedule has been approved by the **County.** It shall be the responsibility of the **Contractor** to prepare and secure the approval of bypassing not specifically identified in the Contract Documents.

I. Responsibility for Spills and Accidental Discharges

In the event the **Contractor** causes or has a spill or accidental discharge for which the **County** is fined by the State of Georgia Department of Natural Resources Environmental Protection Division (EPD), the **Contractor** agrees to remediate the spill or discharge immediately in accordance with current EPD regulations and to pay fines assessed against the **County** and/or **Contractor**, and pay for the **County**'**s** cost associated with efforts to remediate the situation. The **County** shall be notified immediately of such an event.

J. Odor Control

Contractor shall provide approved temporary odor control measures as required to control objectionable odors resulting from its cleaning and/or bypass pumping operations. Approved temporary odor control measures, when required, shall include odor control filters, additional ventilation, and/or covering of manholes.

3.05 PROTECTION OF THE WORK

A. Conduct construction operations so no part of the Work is subjected to damaging operations or influences that are in excess of those to be expected during normal occupancy conditions.

B. Execute work and stockpile spoils and materials to prevent flooding of excavations, below grade construction, and adjacent properties due to rainwater runoff.

C. Protect existing property not indicated to be removed.

D. Provide temporary supports as required to prevent movement and structural failure as designed by a Registered Professional Engineer in the state of Georgia at the Contractor's cost.

E. Equipment and vehicles used on DWM projects shall be clearly marked with the **Contractor's** name and telephone number. The identifying markings may be in the form of magnetic signs, decals, or painted lettering and shall be located on both sides of the equipment/vehicle. The lettering shall be legible, of a contrasting color to the background surface, and at least two inches in height. Markings shall be in place upon initiation of the work on the project site.

F. A copy of the Project Notice to Proceed letter issued by the **County** shall be available on the job site as proof of the contractual relationship of the **Contractor** with the **County**. The letter shall be presented for review upon request by regulatory agencies or other **County** departments that visit the job site.

G. If removal and replacement of a paved private driveway is required, the replacement shall be performed within 2 weeks of removal. The required permanent pavement replacement for public roadways shall be performed within 30 days or within 7 days if the roadway is a state highway or major County arterial roadway. Temporary surface maintenance is the **Contractor's** responsibility and shall be adequate for the volume and type of traffic loads imposed. Temporary asphalt cold mix application, steel traffic plates, etc. shall be utilized as necessary.

H. The **Contractor** shall always maintain copies of permits and approved plans on the project site.

3.06 NOTIFICATION OF SERVICE INTERRUPTION

During progress of work under this Contract, it may be necessary to temporarily interrupt water, sewer, or other utility service to a limited number of customers in the vicinity of the work. It shall be the **Contractor's** responsibility to coordinate the service outage with the utility and to provide proper advance notification (a minimum of 48 hours) to the affected customers.

Due to the nature of businesses and traffic in certain projects' areas, water outages for connections, service changeovers, and other Work may not be allowed during normal work hours. The **Contractor** shall factor these considerations into bid price submitted. Coordination, special lighting, traffic control, employee overtime, special customer notification, etc. shall be included in these considerations by the **Contractor**.

END OF SECTION

SECTION 01011

UNIQUE REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

A. This Section conveys to the **Contractor** unique and unusual stipulations and requirements established for this Project. Some of the stipulations and requirements are a result of negotiations with various entities and organizations, which have an interest in this Project. Some requirements are based on technical aspects of the Project, which are not otherwise conveyed to the **Contractor**. The provisions of this Section shall supersede the provisions of the Division 1 through 16 Specifications, but shall not supersede the Bidding Requirements, Contract Forms, or Conditions of the Contract.

B. If Owner Controlled Insurance Program (OCIP) is implemented in the contract, then OCIP shall govern as follows: In connection with the Work, and for the **Contractor** and those subcontractors deemed eligible by the **County** for participation, the **County** shall implement an OCIP, providing certain insurance coverages as detailed herein. The insurance coverages provided by the OCIP apply only to the Work performed on the Project site. The **Contractor** and its subcontractors shall provide their own insurance for off-site activities. The Builder's Risk/All Risk Property Insurance component of the OCIP shall expressly exclude coverage on **Contractor's** and subcontractors' machinery, tools, and equipment not destined to become a part of the Project Work.

1.02 EXISTING FACILITY OPERATIONS

A. The existing facilities shall remain in operation while the new construction is in progress.

B. The **Contractor** shall coordinate the Work with the **County** so that the construction shall not restrain or hinder the operation of the existing facilities.

C. After having coordinated the Work with the **County**, the **Contractor** shall prepare a submittal in accordance with Specification **Section 01014 Work Sequence** and **Section 01300 Submittals** to include the time, time limits, and methods of each connection or alteration and have the approval of the **County** before Work is undertaken on the connections or alterations.

1.03 SEQUENCING

A. General: The **Contractor** shall be solely responsible for all construction sequencing.

B. Notify the **County** at least 48 hours prior to relocating piping or diverting flows after a Shutdown Plan has been reviewed and approved by the **County**.

C. Sequence Submittal:

1. The **Contractor** shall submit to the **County** for review a proposed sequence with appropriate times of starting and completion of tasks.

2. The **Contractor** may propose alternatives to the sequencing constraints shown in this Section in an attempt to reduce the disruption of the operation of the existing facility or streamline the tasks of this Contract. The **County** is not obligated to accept these alternatives.

D. Parking for **Contractor** personnel shall be fully contained within the site boundaries. No parking is permitted on public roads or on streets within the neighborhood. If necessary, the **Contractor** shall make arrangements for remote parking for its personnel, at no additional cost to the **County**.

E. **Contractor** is advised there are numerous pressurized pipes, energized conduits and duct banks, overhead utilities, and gravity flow systems on the site. The **Contractor** shall be responsible for protecting the existing utility lines and shall be responsible for the repair, damages and all cost resulting from construction activities to these systems. In addition to these requirements, the **Contractor** is required to verify the actual locations of various buried lines shown in the Drawings by carefully excavated test pits and other direct means before starting Work in given areas at no additional cost to the **County**. Special care shall be taken during excavation to mitigate damage potential from previously unknown and active systems. Overhead utilities may require raising or relocation to access site.

F. Unless shown otherwise on the Drawings, the **Contractor** shall restore the site to its original grade. Fill placed at the site to return it to its original grade shall be controlled fill, approved by the **County**. The site shall be grassed, strawed, and mowable. Final landscaping, including trees and shrubs, but not including grassing, shall be paid separately.

G. The **Contractor** shall be responsible for maintaining and cleaning the Site Access Road from the date it occupies the Construction Site through the final completion of the construction period.

H. **Contractor** shall grade site, relocate, set up, and connect utilities, including telephone and internet services for office facilities.

END OF SECTION

SECTION 01014

WORK SEQUENCE

PART 1 - GENERAL

1.01 SCOPE

A. Work under this Section includes construction sequencing and providing temporary facilities as necessary to operate the wastewater collection facilities and prevent wastewater bypasses during the Work. Work shall be scheduled and conducted by the **Contractor** so as to neither impede nor adversely affect any **County** or utility operations.

B. The existing wastewater collection system is currently and continuously receiving wastewater. Those functions shall not be interrupted except as specified herein. The **Contractor** shall coordinate the Work to avoid any interference with normal operation of the collection system. The **Contractor** shall comply with the following general requirements:

1. Provide temporary pumps and other facilities necessary to meet the requirements of this Section.

2. Notify the **County** at least 48 hours before starting to relocate piping or taking existing components out of service.

3. Never bypass untreated or partially treated sewage to surface waters or drainage courses. This is strictly prohibited during construction. If the **Contractor's** operations cause accidental bypassing, the **County** shall immediately be entitled to employ others to stop the bypassing and shall be entitled to do so without written notice to the **Contractor**.

C. Penalties imposed on the **County** because of any bypass caused by the actions of the **Contractor**, its employees, or subcontractors, shall be borne in full by the **Contractor**. This includes legal fees, cleanup, remediation, and other **County** expenses resulting directly or indirectly from the bypass.

1.02 SUBMITTALS

A. Outage Plan: In accordance with the General Conditions, the **Contractor** shall submit a detailed outage plan and schedule for any operations that necessitate removing a pipeline or structure from service. The schedule shall be coordinated with the construction schedule specified in this Section and shall meet the restrictions and conditions specified herein. The detailed plan shall describe the **Contractor's** method for preventing bypassing, the length of time required to complete said operation, the affected facilities, and the equipment the **Contractor** shall provide in order to prevent bypassing.

B. Sequence Submittal: The sequence provided in Part 3 of this Section is offered as a suggestion to the **Contractor**. The **Contractor** shall submit to the **County** for review

and approval a proposed detailed sequence with appropriate times of starting and completion of tasks.

C. Alternate Sequences: The **Contractor** may propose alternate sequences to those shown in Part 3 of this Section if they would reduce disruption of the existing facility's operation or streamline the tasks of this Contract.

1.03 QUALITY ASSURANCE

At least two weeks prior to any proposed activity that will require any portion of the wastewater collection system to be removed from operation, require bypassing, or interrupt flow, the **Contractor** shall schedule a meeting with DWM operating personnel to discuss the **Contractor's** detailed plan for the proposed operation. The plan shall meet the following minimum requirements:

A. Plan shall be written in outline form and presented in a format that shows the progression of events in sequential and/or concurrent order of activity, along with the duration of each activity.

B. The written plan shall be supplemented by understandable drawings, sketches, and details as required to show the logic of the plan.

C. The plan shall delineate the responsibilities of the DWM operating personnel and the **Contractor**, to eliminate delays from conflicting viewpoints about responsibilities when the plan is plan implemented.

D. After discussion of the plan at the meeting, any agreed changes shall be incorporated into the plan and a copy of the plan and details shall be distributed to DWM operating personnel, the **County**, and **Contractor** at least one week prior to commencement of activities. On the day prior to the commencement of activity, a brief meeting of involved parties shall convene to establish the starting time and initial activity of DWM operating personnel and **Contractor's** personnel.

PART 2 - PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

The sequence of construction is outlined for the major items of Work required. The **Contractor** shall coordinate its Work with the DWM operating personnel to minimize disruptions of system operation. The **Contractor** shall ascertain that existing facilities are protected and shall not be damaged as a result of this construction. No settlement of existing facilities shall be acceptable. All work shall be performed in a safe manner.

Unless otherwise permitted, no existing valves or equipment shall be operated by the **Contractor**.

3.02 PROPOSED CONSTRUCTION SEQUENCE

The project shall be constructed in five stages to allow continuous operation of the facilities. The five stages of construction shall generally be performed in sequence, with overlap as required to maintain service in the facilities. The five stages are:

Stage 1 - Preparatory

Stage 2 - Bypass Facilities

Stage 3 - New Pipe, Structures, Valves, and Connections

Stage 4 - Modification to Existing Facilities

Stage 5 - Cleanup and Final Restoration

3.03 REQUIRED SEQUENCES

The following items define the sequence of certain construction steps that shall occur in order to properly and safely operate and maintain the facilities.

3.04 COORDINATION WITH OTHER CONTRACTORS

The performance of the project shall be coordinated with other work going on at the same time on the project site. Certain portions of the project are required to be completed so others can perform their work in a timely manner. The construction schedule prepared by the **Contractor** shall take into account the intermediate requirements depicted on the sequence diagram. The **Contractor** shall bear the responsibility for Work delays that cause delay and damages to other contractors requiring connection to Work under this contract.

3.05 LIMITS OF CONSTRUCTION

Due to the need for other contractors to be performing work on the site, the **Contractor's** access to the site may be limited. The **Contractor** shall have access to some areas of the site only during certain steps during construction. The **Contractor** shall have access to the property defined within the construction limits throughout the project. Additionally, the **Contractor** shall have access to areas within the construction limit of others for only the periods of time required to perform the work.

A. Except where indicated otherwise on the drawings, pipeline and underground construction shall terminate at the construction limit lines indicated on the drawings. The Contractor reaching the construction limit first shall be responsible for adequately capping the line to allow both for testing and for easy continuation of or connection to the line by the Contractor continuing the line.

B. The Contractor may be responsible for performing work within the construction limits of other contractors.

3.06 MISCELLANEOUS CONSTRUCTION

Miscellaneous Work necessary to complete any flow diversion required may include piping, electrical work, diversion plugs, bulkheads, equipment installation, easements, permits, and other activities. The cost for these items shall be included in the **Contractor's** base bid.

END OF SECTION

SECTION 01016

OCCUPANCY

PART 1 – GENERAL

1.01 PARTIAL OCCUPANCY BY COUNTY

Whenever, in the opinion of the **County**, any section or portion of the Work is in suitable condition, it may be put into use upon the written order of the **County** and such usage shall not be held in any way as an acceptance of said Work, or any part thereof, or as a waiver of any of the provisions of these Specifications and the Contract. Pending completion and final acceptance of the Work, all necessary repairs, and replacements, due to defective materials or workmanship or operations of the **Contractor**, for any section of the Work so put into use shall be performed by the **Contractor** at **Contractor's** own expense.

END OF SECTION

SECTION 01040

COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

A. The **Contractor** shall coordinate execution of the Work with subcontractors, other contractors working on related **County** projects, and the **County,** as required, to maintain operation of the existing facilities and satisfactory progress of the Work.

B. Requirements of this Section shall be in addition to those stated in the General Requirements.

C. The **County** requires a written explanation of the **Contractor's** plan for coordinating and accomplishing separate phases of the Work, supplemental to the details provided under **Section 01310 - Construction Schedule**.

1.02 EXISTING UTILITIES

A. Consult with the **County** on a daily basis while the **Contractor** performs demolition, excavation, or any other alteration activity. No water or sewer function, utility, or structure is to be altered, shut off, or removed unless approved in advance, and in writing, by the **County**. The **Contractor** shall give the **County** at least 48 hours advanced notice, in writing, of the need to alter, shut off, or remove such function.

B. Coordinate the Work with the **County** and revise daily activities to avoid adversely affecting system operations. Such revisions in the proposed work schedule shall be accomplished with no additional compensation to the **Contractor**.

END OF SECTION

SECTION 01056

GPS DATA COLLECTION

PART 1 — GENERAL

1.01 SECTION INCLUDES

A. The purpose of this work is to establish the position of asset points and new work in the sanitary sewer collection system using the Global Positioning System (GPS); establish the minimum quality of data; and, specify how the data will be delivered. The GPS position will be established for newly identified sanitary sewer system assets and corrected in the event of existing incorrectly mapped assets.

B. GPS capture is required as described below.

1. Horizontal position of all manholes and new work with an accuracy of ± one foot This applies to all manholes that are on Right-of-Way and all manholes off Right-of-Way.

2. When GPS capture cannot be achieved on manholes and new work, due to canopy or building interferences, the position will be obtained by conventional survey methods tied to the stated reference system at the mapping grade accuracy listed above.

1.02 SUBMITTALS

A. The **Contractor** shall provide to the **County** in writing the following information prior to the set deadline, or at the indicated frequency, whichever is applicable.

Type of Submittal	Time/Frequency of Submittal
Electronic Data related to New Assets	Weekly
Electronic Data and revisions related to Existing Assets	Weekly

1.03 RELATED SECTIONS

A. The Work of the following Sections apply to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of the Work.

1. Section 01510 – Sanitary Sewer Main Television & Inspection (CCTV)

1.04 EXPERIENCED WORKERS

A. Supervisor of the field crews shall have received certified training in the equipment being used in this function and have a minimum of three years' experience in performing such work including safe working practices, etc. Crew Leaders/Field Supervisors obtaining GPS data shall have received certified training in the equipment being used in this

function and have a minimum of one year experience in performing such work including safe working practices, etc.

B. The **Contractor** shall provide the **County** with written documentation indicating all Crew Leaders/Field Supervisors responsible for obtaining GPS data have received certified training in the equipment being used and where required the requisite experience.

C. The **Contractor** shall provide a detailed account of satisfactory GPS experience during the last three years. Those references shall include contact, agency, telephone number and address.

1.05 REFERENCE COORDINATE SYSTEM

A. The horizontal (X&Y) position of points will be referenced to the Georgia State Plane West NAD-83 coordinate system.

1.06 PROVIDED BY COUNTY

A. A map of each area of work will be provided by the **County** from the **County**'s existing GIS map. The map will contain, when available, streets with names, aerial imagery, sewer manholes with asset IDs and sewer lines with existing GIS information available.

1.07 CALIBRATION

A. Calibration shall be carried out in accordance with the GPS equipment manufacturer's instructions. Additional calibrations may be required during the course of the working day for large fluctuations of temperature and/or humidity, also in accordance with the manufacturer's instructions and tolerances.

1.08 INTERFERENCE

A. **Contractor** must obtain a GPS position of sanitary point structures and new work regardless of the overhead conditions or other nearby obstructions interfering with satellite signals, at no additional cost. Coverage conditions will not allow all positions to be obtained by setting directly over the point to be obtained. **Contractor** may use rangefinders or conventional surveying methods to obtain the position of the point.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 GENERAL

A. The **Contractor** shall furnish all labor, tools, materials, software and equipment necessary for capturing the position of all points specified.

3.02 PREPARATION

A. Mission Planning: **Contractor** shall plan the collection of GPS data, using the appropriate software, to optimize the accuracy and speed of data collection while

minimizing the impact and interference on traffic and other activities.

3.03 DATA

A. The inventory database deliverable(s) for newly discovered assets, new work or existing mapped assets with incorrect existing position shall be submitted as an ESRI shapefile or geodatabase with each feature type represented in a different feature class (manholes, mains, etc.). Each attribute for manholes, mains and new work are to be populated as provided in the attribute templates provided below. The data must be in the correct datum capable to be integrated into **County's** ESRI ArcGIS system which is the **County's** standard GIS software.

Manholes Attributes Template

ID	Northing	Easting	Depth	Size	Material

B. Asset IDs for manholes are to be provided by DWM via the guidance in this Specification Section. Asset IDs for newly identified assets found by the **Contractor** not in the existing mapped system inventory or new work installed by the **Contractor** will be coordinated with the **County** and assigned and populated within the electronic GIS deliverable. Northing and easting coordinates shall be populated in system as notated in these Specifications. Manhole and new work depth shall be measured to the nearest 0.1 ft. Manhole and new work depth is to include extent from rim elevation directly above the outflow invert to bottom of outflow invert elevation. Size of manhole is the manhole diameter measured in inches. Manhole wall material (along with any apparent coating) shall be populated with numerical coding described as follows:

Text Code	Description
1	None
2	Precast
3	Brick
4	Block
5	Poured
6	Brick and Concrete
7	VCP
8	PVC
9	Stone and Mortar

Also, any asset ID information as indicated in the field and new work shall be recorded.

Sewer Mains Attributes Template

US_Manhole_ID	DS_Manhole_ID	US_MH_Depth	DS_MH_Depth	Diameter	Material

C. Asset IDs for assets are to be provided by DWM via the guidance in this Specification Section. Asset IDs for newly identified assets found by the **Contractor** not in the existing mapped system inventory or new work installed by the **Contractor** will be coordinated with the **County** and assigned and populated within the electronic GIS deliverable. Upstream and downstream manhole depths (US MH Depth & DS MH Depth) shall be measured to the nearest 0.1 ft and include the extent from rim elevation directly above the outflow invert to the outflow invert elevation. Main diameters shall be measured in inches and rounded to the nearest inch. Main material shall be populated with text coding described as follows;

Text Code	Description
VCP	Vitrified Clay Pipe
Truss	Truss
PVC	Polyvinyl Chloride Pipe
Concrete	Concrete Pipe
RCP	Reinforced Concrete Pipe
DIP	Ductile Iron Pipe
CIP	Cast Iron Pipe
CMP	Corrugated Metal Pipe
Tile	Tile
Brick	Brick

D. For assets with only incorrect coordinate location information but already located within the mapped inventory, only the corrected coordinates will be provided. Necessary data will be logged so that uncorrected positions can be post-processed and coordinated with DWM GIS division, at the discretion of the **County**, to obtain more accurate positions. New work shall be similarly located.

3.04 DELIVERABLES

A. Map corrections to the printed map will be illustrated on the printed map with red markings and delivered at the completion of each week. Supplemental sketches will be provided, as necessary, to clearly depict the actual site conditions and new work.

B. Coordinate and attribute data will be provided in GIS electronic format on a weekly basis as described in these Specifications or as directed by the **County**.

END OF SECTION

SECTION 01060

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

A. The **Contractor** shall, without additional expense to the **County**, be responsible for obtaining National Pollutant Discharge Elimination System (NPDES) permits for discharges from this project to stormwater systems or watercourses, and for complying with any applicable federal, state, county, and municipal laws, codes, and regulations, in connection with the execution of the Work.

B. The **Contractor** shall take proper safety and health precautions to protect the Work, the workers, the public, and the property of others.

C. The **Contractor** shall be responsible for materials delivered and Work performed until completion and acceptance of the Work, except for any completed unit of construction thereof that may heretofore have been accepted.

1.02 NPDES PERMITS FOR STORMWATER DISCHARGES

A. The Federal Water Pollution Control Act (also known as the Clean Water Act, or CWA), as amended in 1987, requires NPDES permits for stormwater discharges associated with industrial activity.

B. On November 16, 1990, (55 FR 47990), the U.S. Environmental Protection Agency (EPA) issued regulations establishing permit application requirements for stormwater discharges associated with industrial activity. These are in Section 122.26 of Section 40 of the Code of Federal Regulations (40 CFR Part 122.26).

C. The November 16, 1990 regulation established the following definition of "stormwater discharge associated with industrial activity" at 40 CFR 122.26(b) (14):

"Stormwater discharge associated with industrial activity" means the discharge from any conveyance that is used for collecting and conveying stormwater and which is directly related to manufacturing, processing, or raw materials storage areas at an industrial plant. For the categories of industries identified in subparagraphs (i) through (x) of this subsection, the term includes, but is not limited to, stormwater discharges from industrial plant yards; immediate access roads and rail lines used or traveled by carriers of raw materials, manufactured products, waste material, or by-products used or created by the facility; material handling sites; refuse sites; sites used for the application or disposal of process waste waters (as defined at 40 CFR 401); sites used for the storage and maintenance of material handling equipment; sites used for residual treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; storage areas (including tank farms) for raw materials, and intermediate and finished products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to stormwater. The following categories of facilities are considered engaging in "industrial activity" for purposes of this subsection:

(x) Construction activity including clearing, grading, and excavation activities except: operations that result in the disturbance of less than five acres of total land area, which are not part of a larger common plan of development or sale"

D. These regulations are effective for activities covered by the regulation on or after October 1, 1992.

E. The **Contractor** shall complete the latest edition of EPA Form 3510-2F. A "Guidance Manual for the Preparation of NPDES Permit Applications for Stormwater Discharges Associated with Industrial Activity," as published by EPA, is available to assist the **Contractor** in the application process.

END OF SECTION

SECTION 01070

ABBREVIATIONS AND SYMBOLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

This section includes a list, but may not be inclusive of all applicable abbreviations for technical societies, organizations, and bodies relevant to the work. Whenever reference is made to the furnishing of materials or testing thereof to conform to the standards of any technical society, organization, or body, it shall be construed to mean the latest standard, code, specification or tentative specification adopted and published at the time of advertisement for Bids whether listed below or not. Such standards are made a part hereof to the extent which is indicated or intended. Unless directed otherwise by the Owner's Representative, the most stringent shall apply.

1.02 DEFINITIONS AND ABBREVIATIONS

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACOE	Army Corps of Engineers
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies
AFBMA	Anti-Friction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
AMCA	Air Moving and Conditioning Association
APA	American Plywood Association
APHA	American Public Health Association
API	American Petroleum Institute
APWA	American Public Works Association
ARC	Appalachian Regional Commission

AREA	American Railway Engineering Association
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials International
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
CCTV	Closed Circuit Television
CERP	Sanitary Sewer Overflow Contingency and Emergency Response Plan
CFR	Code of Federal Regulations
CIPP	Cured-In Place Pipe
CMAA	Crane Manufacturers Association of America
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specifications Institute
CTI	Cooling Tower Institute
DIP	Ductile Iron Pipe
DIPRA	Ductile Iron Pipe Research Association
DEMA	Diesel Engine Manufacturers Association
DTCS	Document Tracking Control System
EDA	Economic Development Administration
EIA	Electronic Industries Association
EPA	Environmental Protection Agency
EPD	Environmental Protection Division
EIA	Electronic Industries Association
FCC	Federal Communications Commission
FHA	Farmers Home Administration
FRA	Federal Railroad Association
FS	Federal Specifications
GA-DOA	Georgia Department of Agriculture
GDOT	Georgia DOT
GIS	Geographic Information System

GSWCC	Georgia Soil and Water Conservation Commission
HEI	Heat Exchange Institute
ICRI	International Concrete Repair Institute
IEEE	Institute of Electronic and Electrical Engineers
IES	Illuminating Engineering Society
I/I	Infiltration and Inflow
IPBA	International Pipe Bursting Association
IPCEA	Insulated Power Cable Engineers Association
IPC	Institute of Printed Circuits
ISA	Instrument Society of America
JSA	Job Safety Analysis
LACP	Lateral Assessment & Certification Program
MACP	Manhole Assessment and Certification Program
MARTA	Metropolitan Atlanta Rapid Transit Authority
MBMA	Metal Building Manufacturers Association
MMA	Monorail Manufacturers Association
MSS	Manufacturers Standardization Society of the Valve and Fitting Industry
MUTCD	Manual for Uniform Traffic Control Devices
NAAMM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NASSCO	National Association of Sewer Service Companies
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NCPI	National Clay Pipe Institute
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NRMA	National Ready-Mix Association
NWP	Army Corps of Engineers Nationwide Permit
OSARP	Ongoing Sewer Assessment and Rehabilitation Program
OSHA	Occupational Safety and Health Administration
PACP	Pipeline Assessment Certification Program
PCA	Portland Cement Association
PCI	Pre-stressed Concrete Institute

PCN	Army Corps of Engineers Preconstruction Notification
PPE	Personal Protective Equipment
PPI	Plastic Pipe Institute
PSARP	Priority Areas Sewer Assessment and Rehabilitation Program
PVC	Polyvinyl Chloride Pipe
RCRA	Resource Conservation and Recovery Act
SBC	Southern Building Code
SDS	Safety Data Sheet
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SOP	Standard Operating Procedure
SSO	Sanitary Sewer Overflow
SSPC	Steel Structures Painting Council
TCA	Tile Council of America
TEMA	Tubular Exchangers Manufacturers Association
UBC	Uniform Building Code
UL	Underwriters Laboratories
USDC	United States Department of Commerce
USEPA	United States Environmental Protection Agency
WCTS	Wastewater Collection and Transmission System
WPCF	Water Pollution Control Federation

1.03 SYMBOLS

Symbol and material legends shall be as scheduled on the Contract Drawings.

END OF SECTION

SECTION 01100

SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.01 CONNECTIONS TO EXISTING SYSTEM

The **Contractor** shall perform the Work necessary to locate, excavate, and prepare for connections to the terminus of the existing systems as shown on the Drawings. The cost for this Work and for the actual connection to the existing systems shall be included in the bid price for the project and shall not result in any additional cost to the **County**. Connections shall be made only after approval by the **County**.

1.02 RELOCATIONS

The **Contractor** shall be responsible for the relocation of structures, including but not limited to light poles, signs, sign poles, fences, piping, conduits, and drains that interfere with the positioning of the Work as set out on the Drawings. The cost of such relocations shall be included in the bid price.

1.03 EXISTING UNDERGROUND PIPING, STRUCTURES, AND UTILITIES

A. The **Contractor** shall exercise extreme care before and during excavation to locate and flag various sewer, water, gas, telephone, electrical, or other utility lines not shown on the Drawings to avoid damage. Should damage occur to an existing line, the **Contractor** shall bear the costs associated with the damage and repair the line at no cost to the **County.**

B. The **Contractor** shall note that the locations of existing underground piping structures and utilities are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping to be encountered.

C. The **Contractor** shall notify the **County** of existing piping and utilities that interfere with new construction.

D. The **Contractor** shall exercise care in any excavation to locate existing piping and utilities. Utilities that do not interfere with complete Work shall be carefully protected against damage. Any existing utilities damaged in any way by the **Contractor** shall be restored or replaced at the **Contractor's** expense as directed by the **County**.

1.04 CONNECTIONS TO WORK BY OTHERS

A. Under this Contract, and as shown on the Drawings, the **Contractor** shall construct pipelines that are to be connected to pipelines constructed by others.

B. The **Contractor** shall connect pipelines built under this Contract to pipelines constructed by others by removing the plugs and making the connection.

C. The **Contractor** shall lay any pipelines (under this Contract) not constructed by others to the required line and grade, terminated with a plugged connection precisely at the location indicated on the Drawings, and then backfilled and marked with a yellow stake exposed a minimum of 3 feet above grade.

1.05 WATER FOR CONSTRUCTION PURPOSES

The **Contractor** shall be responsible for any cost of water used on the Project. A water meter and backflow device shall be obtained from the DeKalb County DWM main office for recording water used for cleaning and other Work items requiring water.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 SUMMARY

A. The **County** shall schedule and administer a preconstruction meeting, and may schedule periodic progress meetings, and specially called meetings throughout progress of the Work. The **County** shall set the agenda for the meetings and preside at the meetings. The **Contractor** shall make physical arrangements for the meetings pursuant to the **County's** requirements. Meetings are not a pay item.

B. Representatives of the **Contractor**, subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

1.02 PRECONSTRUCTION MEETING

A. The **County** shall schedule a Preconstruction Meeting prior to the start of construction.

B. The Preconstruction Meeting shall be attended by the following:
   1. **County's** representative(s)
   2. **Contractor's** Project Manager and Superintendent
   3. Others as appropriate or required by the **County**

C. The Preconstruction Meeting will generally have the following agenda:
   1. Designation of responsible personnel
   2. Distribution and discussion of list of major subcontractors and suppliers
   3. Projected construction schedule with critical Work sequencing
   4. Major equipment deliveries and priorities
   5. Procedures and processing of:
      a. Submittals
      b. Requests for Information (RFIs)
      c. Change Documents
         1. Requests for Proposals (RFPs)
         2. Work Authorizations
         3. Proposed Change Order Requests (CORs)
      d. Field Decisions and Clarification Memos
      e. Applications for Payment
      f. Change Orders
   6. Procedures for maintaining Record Documents (**Section 01350 - Project Document Tracking and Control Systems**)
   7. Periodic Meeting Schedule
   8. Mobilization Form Submittal – Contractor shall complete and submit a Mobilizations Request form after the following have been completed:

a. NTP Received
b. Preconstruction Meeting completed and minutes reviewed and accepted
c. Safety Plan, Construction Quality Plan, and Permit/ Easement Plan submitted to and approved by **County**

1.03 PERIODIC PROGRESS MEETINGS

A. Project Progress Meetings shall be held monthly throughout the project duration. The **County** may alter the timing of, or add supplemental, scheduled periodic progress meetings, at its discretion.

B. The Project Progress Meetings shall be attended by the following:
   1. **County's** representative(s)
   2. **Contractor's** Project Manager, Superintendent, and other appropriate representative(s)
   3. Others as appropriate or required by the **County**

C. The Progress Meetings will generally have the following agenda:

1. Review Work progress since last meeting
2. Discussion of Construction Schedule for next period
3. Status of major equipment and material deliveries
4. Construction problems affecting progress
5. Field observations, including Safety Report(s)
6. Status of pending RFIs and changes
7. Stakeholder complaints/public outreach
8. Status of permits and easements
9. Status of invoicing
10. Other business

1.04 OTHER MEETINGS

A. Schedule Progress Meetings

As per **Section 01310 - Construction Schedule**, during weekly progress meetings, the **Contractor** shall submit a Look-Ahead Schedule. This schedule shall cover four weeks: the immediate past week, the current week, and the forthcoming two weeks. This schedule shall include activities that are complete, started, incomplete or underway, or scheduled to be performed during this four-week timeframe. Results of the Progress meetings shall be reported in the Project Progress Meetings.

B. Specially-called meetings may be requested by either party or by other affected entities. Requests shall be made through the **County**, which shall coordinate the meeting schedule. Specially-called meetings shall be held as warranted by:

1. Unforeseen developments during construction or as needed to coordinate special events, such as tie-ins or system shutdowns

2. Concerns regarding individual project performance and adherence to the schedule of construction

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01210
MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.01 SCOPE

A. Work includes furnishing labor, equipment, tools, materials, and performing operations required to complete the Work satisfactorily, in-place, as specified, and as indicated on the Drawings.

B. The costs of required items of work and incidentals necessary for the satisfactory completion of the Work shall be considered as included in the Total Bid. The cost of work not directly covered by the pay items shall be considered incidental to the contract and no additional compensation shall be allowed.

C. The **Contractor** shall take no advantage of any apparent error or omission on the Drawings or Specifications, and the **County** shall be permitted to make corrections and interpretations as may be deemed necessary for fulfillment of the intent of the Contract Documents.

1.02 SUBMITTALS

A. The **Contractor** shall submit to the **County** for approval, in the form directed or acceptable to the **County**, a complete schedule of values of the portions of the Work, including quantities and unit prices, aggregating the Contract Price. The **County** shall not approve an unbalanced breakdown providing for overpayment to the **Contractor** on items of Work that would be performed first.

B. The **Contractor** shall submit application for payment on a form approved by the **County** showing allowances, lump sum schedule of value items, and unit price items in accordance with Section 01310.

1.03 UNIT PRICE ITEMS

A. Payment for Work shall be in accordance with the unit price bid items in the Bid Schedule and shall be full compensation for labor, materials, and equipment required to furnish, install, construct, and test the Work covered under the unit price bid item. Work for which there is no price schedule item shall be considered incidental to the Work and no additional compensation shall be allowed.

B. Payment shall be made only for the actual quantities of work performed in compliance with the Drawings and Specifications. The **Contractor** shall be paid an amount equal to the approved quantity times the applicable unit price. Any unused balance of the unit price work shall revert to the **County** upon completion of the project.

C. All unit price work shall be considered as part of the Work to be performed within the time limits specified elsewhere for Substantial Completion and Project Completion. No increase in contract time shall be allowed for increases in quantities of unit price work performed beyond the quantities shown in the Bid Schedule, unless it can be

demonstrated that the additional Work performed under the unit price item is on the critical path of the Project Schedule and has produced an increase in time to the Contract.

1.4 MEASUREMENT OF QUANTITIES

A. Final payment quantities shall be determined from the record drawings. The As-Built Drawings lengths, dimensions, quantities, etc. shall be determined by a survey after completion of the required Work. The precision of final payment quantities shall match the precision shown for that item in the Bid Schedule. Measurements shall be taken according to the United States standard measurements and in the manner as specified in these Specifications.

B. Measurement Devices

1. Scales shall be inspected, tested, and certified by the applicable weights and measures department within the past year, and shall be of sufficient size.
2. Metering devices shall be inspected, tested, and certified by the applicable department within the past year.
3. Volume shall be determined by cubic dimension by multiplying mean length by mean width by mean height or thickness.
4. Area shall be determined by square dimension by multiplying mean length by mean width or height.
5. Linear measurement shall be measured by linear dimension, along the item centerline or mean chord.
6. Stipulated price measurement shall include items measured by number, weight, volume area, length, or combination thereof as appropriate.

Item	Method of Measurement
AC	Acre - Field Measure
AL	Allowance
CY	Cubic Yard - Field Measure within limits specified or shown, or measured in vehicle by volume, as specified
EA	Each - Field Count
GAL	Gallon - Field Measure
HR	Hour
LB	Pound(s) - Weight Measure by Scale
LF	Linear Foot - Field Measure
LS	Lump Sum - Unit is one; no measurement will be made
MO	Month
SF	Square Foot
SY	Square Yard
TON	Ton - Weight Measure by Scale (2,000 pounds)
VF	Vertical Foot - Field Measure

SECTION 1 – UNIT PRICE BID ITEMS

1.1 8-INCH DUCTILE IRON SANITARY FORCE MAIN PIPE

A. Measurement for payment of furnishing and installing ductile iron sanitary force main pipe shall be on a linear foot basis as determined by measurement along the centerline of the pipe in place. Payment shall constitute full compensation for work necessary for installation of ductile iron distribution pipe, including but not limited to furnishing, transporting, storing, and installing the pipe; clearing of easement; saw cutting asphalt pavement, excavation, removal, and disposal of asphalt or concrete pavements, and excavated material; excavation support system, utility support system, dewatering, temporary water service, backfilling, and compaction; cleaning, treating, and testing; site restoration; and other specified work.

B. Depth of installation is as indicated on the drawing details, or defined in the specifications, or as directed by the **County**. Excavation is unclassified.

1.2 8-INCH DUCTILE IRON SANITARY FORCE MAIN PIPE, ADDITION FOR DEEP BURY, 0-4 FEET DEEPER THAN SHOWN ON THE DRAWINGS

A. Measurement for payment of Ductile Iron Sanitary Force Main Pipe, Push-On Joint (size) Diameter, Addition for Deep Bury, 0 to 4 feet deeper than shown on the drawings shall be on a per linear foot basis. Payment for installing force main pipe at a lower grade than indicated shall be based upon the actual depth as instructed by the **County**, in accordance with the provisions of the contract documents. Payment for force main installed at depths greater than that shown in the drawings shall be made in addition to the unit prices in this section. Payment shall constitute full compensation for labor, materials, and equipment necessary to install the force distribution pipe at a depth greater than 4 feet.

B. Depth of installation is as indicated on the drawing details or defined in the specification, or as directed by the **County**. No extra compensation shall be made for depths greater than 4 feet or not shown on the approved drawings without approval from the **County**. Excavation is unclassified.

1.3 DUCTILE IRON FITTINGS

Measurement for payment to furnish and install ductile iron fittings shall be at the unit price bid per pound for such approved fittings furnished. Weight shall be based on published weights provided by the fitting manufacturer. Payment for furnishing and installing fittings shall constitute full compensation for work required to furnish and install the fittings, including but not limited to: providing and installing joint restraint; purchasing, transporting, storing, and delivering to the worksite the necessary materials, tools, equipment, and labor; saw cutting asphalt pavement, excavation, dewatering, backfilling, compaction, site restoration, and cleanup; removal and disposal of asphalt or concrete pavements and excavated material; excavation support system, utility support system; dewatering, temporary water service, cleaning, treating, and testing; and other specified work.

1.4 FURNISH AND INSTALL PLUG VALVES WITH VALVE BOX AND EXTENSION

Measurement for payment to furnish and install plug valves shall be on a per each basis. Payment shall be based upon actual quantity of each valve furnished and installed, in accordance with the requirements of the Contract Documents. Payment shall constitute full compensation for work necessary to install the valves, including, but not limited to: the purchase, delivery to the Work Site, on-site storage, delivery to the work areas, surface preparation, saw cutting asphalt pavement, excavation, removal, and disposal of asphalt or concrete pavements and excavated material; excavation support system, utility support system, dewatering, temporary water service, placement, backfilling and compaction; cleaning, treating and testing; cleanup, including valve box, extension, concrete collar, if required; and other specified work.

1.5 6FT DIAMETER ACCESS MANHOLE

Measurement and payment of each 6-ft diameter access manhole shall be measured in place and payment made for approved concrete manhole assembly installation per each installed. The unit price bid for concrete manhole assembly shall include all materials, labor and incidentals necessary for the complete installation of each concrete manhole assembly as called for in these specifications.

Unit price for each concrete manhole assembly shall include up to ten vertical feet of complete manhole assembly. A complete manhole assembly at a minimum shall consist of base foundation preparation and materials, a manhole base, riser sections of the diameter called for on the contract drawings, a reducer section, grade rings, manhole ring, and manhole cover. The manhole assembly shall provide a means of egress via embedded ladder rungs or other as shown on the contract drawings. No extra payment for grade ring adjusters for final grade shall be paid.

1.6 ROCK EXCAVATION

Measurement for payment for rock excavation shall be on a per cubic yard basis. Payment shall constitute full compensation for work necessary for rock excavation in accordance with the Plans and Specifications, including, but not limited to, labor, materials, and equipment.

A. For pipeline excavation, the volume of rock excavation shall be calculated by multiplying allowable specified trench width times the horizontal distance along the survey centerline times vertical height, averaged at 25 feet, of rock excavation.

B. For other structures, including manholes, maximum width shall be 24 inches beyond each edge of the completed structure. Depth for payment purposes shall be no deeper than 12 inches below the bottom of the manhole or structure.

C. No payment shall be made for rock excavation below the required grade or outside the width pay limits as specified in Section 02324 - Trenching and Trench Backfilling.

D. Payment shall include the cost of removal and lawful disposal of the rock from the site.

1.7 Trenchless Method

Measurement for payment for trenchless shall be on a linear foot basis. Payment shall constitute full compensation for work necessary for a complete installation, including, but not limited to: labor, materials and supplies; equipment required for the handling and installation of the casing and carrier pipe, access, and receiving shafts; shaft support, shoring, and bracing removal; groundwater control, annular space fill, spacers, casing end plugs, and other associated material; surface settlement monitoring; on-site storage, delivery to the work areas, site preparation, backfill, complete restoration; and cleanup.

1.8 25 MM SUPERPAVE FOR PERMANENT ASPHALT PAVEMENT REPLACEMENT

Measurement for payment for 25 MM Superpave for Permanent Asphalt pavement replacement shall be per square yard, determined by multiplying the longitudinal length of the pavement cut times the allowable specified payment width of the trench. Payment shall be full compensation for furnishing labor, materials, tools, testing, and equipment necessary to install 25 MM Superpave for Permanent Asphalt Pavement Replacement, and shall include furnishing, hauling, preparation, placement of 25 MM Superpave materials, and prime coat for permanent asphalt paving. Pavement thickness shall be as shown on the standard details.

All pavement damaged outside the payment width shall be repaired as specified by the **County** and no additional payment shall be allowed for such work outside the payment width.

1.9 CONCRETE BASE OR PAVEMENT REPLACEMENT FOR WATER OR SEWER LINES

Measurement for payment of concrete pavement replacement for water or sewer lines shall be on a square yard basis determined by multiplying the longitudinal length of pavement to be replaced by the allowable specified payment width. Payment shall constitute full compensation for Work necessary to install the concrete pavement, including, but not limited to: the purchase, delivery to the Work Site, surface preparation, placement, protection, testing, and cleanup.

1.10 REMOVE AND REPLACE CONCRETE CURB AND GUTTER

Curb or curb and gutter completed in place and accepted is measured in linear feet along the face of the curb.

Each type of curb and curb and gutter remove and replaced shall be paid for at the contract unit price bid per linear foot. Payment is full compensation for removal of existing curb or curb and gutter, furnishing of materials, preparing subgrade or pavement surface, installing, and maintaining curb or curb and gutter installed.

1.11 REMOVE AND REPLACE CONCRETE SIDEWALK

Measurement for payment for concrete sidewalk replacement shall be per square yards. Payment shall be full compensation for furnishing labor, materials, tools, and equipment necessary to install and finish concrete sidewalk, and shall include: excavation, backfilling, compaction, and restoration of property; disposal of existing materials; joints and special construction at driveways or other entrances and points; hauling and placing materials; and incidentals necessary to complete the Work. Payment shall include approaches through curb and gutter indicated on the Plans.

1.12 HDPE SANITARY FORCE MAIN PIPE

Measurement of the pipe in place will be along the main axis of the pipeline. No deduction in the length of pipe will be made for space occupied by valves, specials, and fittings.

The unit price bid for pipe shall include all of the materials, labor and incidentals necessary for the completion of the pipeline through existing 24-inch force main as shown on drawings and as called for under SECTION 02624 HIGH DENSITY POLYETHYLENE PIPE, except as specifically called for in other pay items herein.

The unit price bid for force main shall include and cover all clearing and grubbing on the entire pipeline right-of-way and the disposal of all debris in dressing and finishing after the line is laid. There will be no additional pay where extra depth is incurred due to valve locations, tie-ins, restrained joint requirements, conflicts with other utilities, or other field conditions.

The **Contractor** shall be responsible for the reuse of acceptable in-place material including the drying or wetting to obtain suitable moisture content for compaction during backfill operations under Pay item 1.12. All excess excavated material shall be disposed of without extra cost to the Owner.

Pipe will be paid for at the unit price bid for various sizes and types.

1.13 RESTRAINED JOINTS / RETAINER GLANDS

Special restrained joints will be counted in place and paid for at the unit price bid per each type and size listed in bid proposal. A restrained joint shall be defined as the separated or loose portion of materials that are installed separately from pipe, fittings, or valves. Portions of restraint that are permanently attached to pipe, fittings, or valves and/or are an integral part of the system, do not qualify for additional payment. The restraint system shall be counted only once and shall be a complete system for each joint that is to be restrained.

In the case of straight pipe, the payment for each restrained joint will be paid separate from the unit price per foot of pipe. In the case of ductile iron fittings, the payment for restrained joints will be paid separately from the payment for fittings. In the case of valves, the payment for each restrained joint will be paid separate from the unit price bid for each valve.

1.14 AIR & VACUUM VALVE ASSEMBLY

Measurement of each air and vacuum relief valve shall be measured in place and payment made for approved air and vacuum relief valve installation per each installed. The unit price bid for air and vacuum relief valves shall include all materials, labor and incidentals necessary for the complete installation of each air and vacuum relief valve and associated gate valve as called for in these specifications.

1.15 4-FT CONCRETE MANHOLE ASSEMBLY

Measurement of each concrete manhole assembly shall be measured in place and payment made for approved concrete manhole assembly installation per each installed. The unit price bid for

concrete manhole assembly shall include all materials, labor and incidentals necessary for the complete installation of each concrete manhole assembly as called for in these specifications.

Unit price for each concrete manhole assembly shall include up to ten vertical feet of complete manhole assembly. A complete manhole assembly at a minimum shall consist of base foundation preparation and materials, a manhole base, riser sections of the diameter called for on the contract drawings, a reducer section, grade rings, manhole ring, and manhole cover. The manhole assembly shall provide a means of egress via embedded ladder rungs or other as shown on the contract drawings. No extra payment for grade ring adjusters for final grade shall be paid.

Unit price for each vertical foot in excess of ten vertical feet shall be measured and paid per vertical foot installed of the manhole riser section installed.

1.16 POLYETHYLENE ENCASEMENT

Polyethylene encasement will be measured in place along the length of pipe and paid for at the unit price bid per linear foot for single wrap encasement as listed in the bid proposal. Payment will be for the single wrap encasement of all pipes as required by Specification Section 02537 Ductile Iron Pipe and Fittings.

1.17 CONNECTION TO EXISTING FORCE MAINS

Payment for this item will be at the unit price bid for each location and size listed in the bid proposal. Payment shall be full compensation for locating, cutting-in and connecting to the existing facilities and removal of existing piping as necessary to complete the connection. Pipe and special fittings used in making the connection shall be included in the bid price.

1.18 SUBGRADE STABILIZER STONE

Measurement for payment for subgrade stabilizer stone will be made by the ton.

Weight for payment will be taken from dray tickets for stone actually placed in accordance with the following limitations:

A. Stone used for stabilizing trench bottom in wet areas will be paid for.

B. Stone used for type 4 and type 5 bedding conditions will be paid for.

C. Stone used for constructing temporary driveways will be paid for.

D. Stone used for constructing temporary travel lane adjacent to existing roadway will be paid for.

E. Stone used for construction haul roads will not be measured for payment, nor will that which is placed contrary to contract requirements.

1.19 CAST IN PLACE CONCRETE

Cast-in-Place concrete will be measured in place and paid for at the unit price bid per cubic yard in accordance with Section 03300 of the Specifications.

1.20 GRADED AGGREGATE BASE

Graded aggregate base is measured by the ton, mixed and accepted in place.

Graded aggregate base will be paid for at the contract unit price per ton. This unit price shall be full compensation for materials, the shaping and the compaction of the existing roadbed, loading, hauling, and unloading, crushing and processing, mixing, spreading, watering, compacting and shaping, maintenance, priming, when required, and all incidentals necessary to complete the work.

1.21 MILLING EXISTING PAVEMENT

Milling existing pavement is measured by the square yard.

Milling existing pavement will be paid for at the contract unit price per square yard. Payment is full compensation for furnishing labor and equipment, milling, hauling, disposing of milled material, and satisfactorily performing the work.

1.22 9.5MM SUPERPAVE PAVEMENT OVERLAY

Pavement overlay is measured by the square yard.

Pavement overlay will be paid for at the contract unit price per square yard. The unit price shall include the application of a tack coat prior to pavement overlay and the placement of a surface pavement of the type shown on drawings and to the depth shown on drawings. Payment is full compensation for furnishing labor, material, and equipment, applying tack coat, placing pavement overlay, and satisfactorily performing the work.

1.23 REMOVE AND REPLACE ASPHALT DRIVEWAY

Asphalt driveways will be measured in place and the unit of measurement shall be the square yard.

Asphalt driveways will be measured in place and payment will be made at the contract unit price bid per square yard. The unit price will be full compensation for smoothing the driveway bed and leveling a 2" thick layer of asphalt. Maintenance of the driveway during construction shall be included in unit price.

1.24 REMOVE AND REPLACE CONCRETE DRIVEWAY

Concrete driveways will be measured in place and the unit of measurement shall be the square yard.

Asphalt driveways will be measured in place and payment will be made at the contract unit price bid per square yard. The unit price will be full compensation for smoothing the driveway bed and placing a 4" thick concrete driveway. Maintenance of the driveway during construction shall be

included in unit price.

1.25 REMOVE AND REPLACE FENCE (ALL TYPES & SIZES)

Payment for this item will be at the bid price per linear foot for all sizes and types of fence as listed in the bid proposal. The length shall be measured in place after replacement. Fencing shall be removed only where necessary for carrying out the work or as directed by the Engineer. Where the existing fence materials are unsuitable for replacement, the **Contractor** shall furnish new materials, the costs of which are to be included in the bid price. Bid price shall include all labor, material, tools and equipment to carry out the work. No payment will be made except when fence is replaced.

1.26 TRAFFIC STRIPE

Traffic Stripe (all types) is measured by the linear foot.

Payment for applying traffic stripe will be made at the unit price bid per linear foot. The unit price bid shall be full compensation for all tools, labor, equipment, materials, traffic control, protection of traffic stripe against traffic and weather and any incidentals necessary for the installation of the traffic stripe as required. The unit bid shall be for solid and skip traffic stripe of any size and color required.

1.27 TEMPORARY SILT FENCE (Sd1)

Temporary silt fence shall be paid for at the unit price bid per linear foot and will be measured in place. The quantity shall be field measured and only the quantity installed at the engineer's approval will be measured for payment. Double row silt fence will be measured in length per each row placed. The unit price bid shall be full compensation for all material, labor, tools and equipment necessary to install, maintain, and remove the temporary silt fence as specified in the contract documents. Silt fence will only be measured for payment once.

1.28 HAY BALE BARRIER

Hay bale barriers will be measured in place and paid for the unit price bid per linear foot. Payment shall be full compensation for all labor tools, equipment, materials and any incidentals necessary to install, maintain and remove hay bale barriers. No payment will be made for hay bale barriers placed without the approval of the engineer.

1.29 ROCK CHECK DAM (Cd)

Rock check dams will be counted in place and paid for at the unit price bid for each. Payment shall be full compensation for all labor, tools, equipment, materials and any incidentals necessary to install, maintain and remove check dams. No payment will be made for check dams placed without the approval of the engineer.

1.30 RIP-RAP (St)

Rip-Rap will be measured in place paid for at the unit price bid per square yard. Placement of Rip-

Rap will be as directed by the engineer. Unit price bid shall be full compensation for all labor, materials and equipment required to furnish and install required rip-rap.

1.31 CONSTRUCTION EXIT (Co)

Construction exits will be counted in place and paid for at the unit price bid for each. The unit price bid shall be full compensation for all material, labor, tools and equipment necessary to install, maintain and remove all construction exits as specified in the contract documents. Only exit locations approved by engineer will be counted for payment.

1.32 STRAW MULCH STABILIZATION (Ds1)

Straw mulch stabilization shall be paid for at the unit price bid per square yard and will be measured in place. Measurement shall be along the centerline of the pipeline multiplied by the average width of the area mulched. The unit price bid shall be full compensation for all material, labor, tools and equipment necessary to install the straw mulch stabilization as specified in the contract documents.

1.33 TEMPORARY GRASSING (SEED) (Ds2)

Temporary grassing shall be paid for at the unit price bid per square yard of grassing. Temporary grassing shall include seed, fertilizer and asphaltic emulsion. **Contractor** shall be responsible for replacing all grass destroyed during installation of force main. Grassing area measured for payment will be limited to a strip not to exceed 40 FEET wide measured along the length of the force main. No modification shall be made in the unit price.

1.34 PERMANENT GRASSING (SEED) (Ds3)

Permanent grassing shall be paid for at the unit price bid per square yard of grassing. Permanent grassing shall include seed, mulch, fertilizer and asphaltic emulsion. **Contractor** shall be responsible for replacing all grass destroyed during installation of force main. Grassing area measured for payment will be limited to a strip not to exceed 40 FEET wide measured along the length of the force main. Where grassing is required in areas adjacent to any residential or commercial lawn, the type of grass to be planted and grown shall match the type of grass growing on the adjacent lawn. No modification shall be made in the unit price.

1.35 INLET SEDIMENT TRAP (Sd2)

Inlet sediment traps will be counted in place and paid for at the unit price bid for each. Payment shall be full compensation for all labor, tools, equipment, materials and any incidentals necessary to install, maintain and remove sediment traps. No payment will be made for sediment traps placed without the approval of the engineer.

1.36 STORM DRAIN OUTLET PROTECTION (St)

Storm drain outlet protection will be counted in place and paid for at the unit price bid for each. Payment shall be full compensation for all labor, tools, equipment, materials and any incidentals necessary to install, maintain and remove outlet protection. No payment will be made for outlet

protection placed without the approval of the engineer.

1.37 NPDES PERMIT COMPLIANCE

Payment for compliance with NPDES permit requirements shall be made under a lump sum bid to be paid monthly in equal payments. The lump sum bid shall be full compensation for compliance with NPDES requirements as described in Specification Section 01060 including the employment of an Environmental Professional for specified services. This item is inclusive of all associated fees to the Georgia Environmental Protection Division (EPD), DeKalb County, and other agencies as necessary for the compliance with erosion control requirements as specified and shown on drawings and required by law or regulation.

1.38 GROUTING EXISTING FORCE MAIN

Measurement for the grouting of existing force mains shall be on the linear foot basis as measured in place.

Payment for grouting existing force main shall be made under a unit price bid per linear feet. The unit price bid shall be full compensation for all work including cutting of existing force main, installation of vents as required, grout materials compliant with GDOT requirements, installation of grout, and removal of vents.

1.39 COUPLINGS

Payment for this item will be made at the unit price bid listed in the proposal and shall be full compensation for all tools, materials, equipment, and labor necessary to place either install pipe couplings jointing pipes of different material. Measurement for payment shall be based on each coupling installed.

1.40 REMOVE & REPLACE CULVERT PIPE (a.CMP & b.Concrete 24in – 36in)

Culvert pipe completed in place and accepted is measured in linear feet along the center line of the pipe.

Each type of culvert pipe removed and replaced shall be paid for at the contract unit price bid per linear foot. Payment is full compensation for removal of existing culvert pipe, furnishing of materials, preparing bedding and installing backfill and subgrade materials, installing, and maintaining culvert pipe installed and connecting new culvert pipe to existing culvert pipe.

1.41 VIDEO DOCUMENTATION

Video documentation will be paid for under a lump sum bid. This price shall include all cost for all materials, all labor, tools, equipment, and incidentals necessary to video record the project.

The **Contractor** shall employ the services of a professional video company to record the project conditions prior to construction. The video record shall document the project from beginning to end within the construction limits. The Pre-Construction Video shall document existing damage to

curbs, streets, sidewalks, driveways, trees, poles, and surrounding structures. The video recording shall be time and date stamped and geo-coded with northings, eastings, and direction of view. The video recording shall be suitable for legal proceedings.

1.42 REMOVE & REPLACE GUARDRAIL

Guardrail will be measured in place and the unit of measurement shall be in linear feet.

Payment for removing and replacing guardrail will be made at the unit price bid per linear foot. The unit price bid shall be full compensation for all tools, labor, equipment, materials, traffic control, temporary guardrail for the protection of traffic, weather and any incidentals necessary for the removal and replacement of guardrail. The unit bid shall be for guardrail of any size and type. Existing guardrail shall be removed and replaced the type of guardrail matching the existing and compliant with current GDOT specifications and standards.

1.43 SODDING

Sodding shall be paid for at the unit price bid per square yard of sod. **Contractor** shall be responsible for placing sod required during installation of force main. Sodded area measured for payment will be measured along the length of the force main for the width of sod. Where sodding is required in areas adjacent to any residential or commercial lawn, the type of grass to be planted and grown shall match the type of grass growing on the adjacent lawn. No modification shall be made in the unit price.

1.44 CONCRETE DITCH CAP

On top of the trench for any force mains that are installed in roadways or driveways, a layer of concrete shall be placed on the top of the compacted trench (6” for driveways, 8” for public streets). Width is to be nominal diameter of pipe plus 4’-0” feet. The **Contractor** shall be paid on a square yard basis for concrete actually installed in trenches. This item will not be payable if the concrete is not installed as shown on the detailed drawings.

1.45 MOBILIZATION AND DEMOBILIZATION

Payment for the **Contractor**’s mobilization and demobilization efforts shall be made in accordance with the specifics defined in the M&P section of Section 01012.

1.46 TRAFFIC CONTROL

Payment for traffic control shall be made at the lump sum price bid to be paid monthly in equal payments for all traffic control required for all force main work, including all lane closures, sign boards, cones, jersey barriers, detours, signage and other incidentals required by the government entity controlling the right-of-way.

1.47 LANDSCAPING

Payment made for landscaping is for landscaping items removed and replaced that are not covered by other proposal items. The price shall include, but not limited to all labor, materials,

laying and staking, fertilizing, mulching and guarantees involved in the installation. Payment shall be made at the lump sum price bid.

1.48 REMOVE AND REPLACE HEADWALL (24in – 36in)

Removing and replacing storm drain headwalls shall be paid for at the unit price bid per each to remove and replace the headwall to the satisfaction of the **County** and in accordance with DeKalb County standards.

1.49 DUST CONTROL

Dust control efforts completed in accordance with the Manual for Erosion and Sediment Control in Georgia shall be paid for at the lump sum price bid and shall include all materials, equipment, tools and labor necessary to complete the work. Payment for this item shall be included in the final pay request only.

1.50 ADDITIONAL COMPENSATION FOR ROCK IN BORE

Where extremely hard solid rock is encountered, such as solid blue granite, and the casing cannot move forward with a normal soil cutting head, and when the **County** has so directed, the **Contractor** shall be authorized to utilize a hard-face rock cutting head and shall be paid an additional fee per linear foot for the length of casing that is cut through solid rock. This extra fee per linear foot shall be added to the base unit cost per linear foot for steel casing and shall be paid for the remainder of the length of the casing to be installed, and this fee per linear foot shall be full compensation for all costs associated with providing and using the hard-face rock cutting head, providing and delivering the water supply needed for the cutting head, and other incidentals associated with installing a cased bore through solid rock.

1.51 CCTV INSPECTION OF EXISTING PIPELINE

Measurement and payment for CCTV inspection and cleaning of existing pipeline in accordance with Specification Section 02742 will be per linear foot and will be as shown on the drawings or as directed by the **County.**

1.52 REMOVE EXISTING 24-INCH BENDS

Measurement and payment for removal of existing 24-inch bends will be per each as shown on the drawings or as directed by the **County** and shall include proper disposal in accordance with the Specifications as well as all applicable laws and regulations.

1.53 REMOVE EXISTING 24-INCH GATE VALVE

Measurement and payment for removal of existing 24-inch gate valves will be per each as shown on the drawings or as directed by the **County** and shall include proper disposal in accordance with the Specifications as well as all applicable laws and regulations.

SECTION 2 – ALLOWANCES

2.1 OWNER'S ALLOWANCE

A. When an allowance has been established as the value of this item, this allowance shall be used to pay the costs, where the amounts are determined as specified in General Requirements Section GR-5, Changes in the Work and Change Orders, where directed by the County.

B. The allowance specified in the Bid Schedule are to establish a fund to pay the cost of items for which the **County** could not establish accurate quantities and/or detailed scope of work, County-directed compliance testing and/or County-directed site restoration, unforeseen utility conflicts and site conditions. The **Contractor** shall submit for review and approval by the **County** a proposed cost of services prior to performance of the Work. This Work shall be completed only at the written direction of the **County** after the cost of such Work has been approved

C. The **Contractor** shall be responsible for the payment for these services to the appropriate payee providing such service, and shall submit evidence of payments to the **County** prior to their inclusion in the progress payments.

D. The **County** shall make payment for invoices submitted by the **Contractor** subject to the Contract Documents. **Contractor** shall not receive any additional compensation for bond or insurance costs for work executed using allowance funding.

E. Allowance allocations shall only be paid to the **Contractor** for completed work authorized by the **County**. Allowance dollar amounts not expended shall revert to the **County** at the completion of the project. Should the final allowance costs be less than the specified amount of the allowance, the Contract shall be adjusted accordingly by change order. The amount of change order shall not recognize any changes in handling costs at the site, labor, overhead, profit, and other expenses caused by the adjustment to the allowance item.

F. County-Directed Site Restoration

   i) The costs of final grading, site restoration (consisting of grassing, shrub, and tree plantings, and maintenance thereof, shown in the Drawings and/or required by the Specifications) are not covered in the Owner's Allowance, and shall be included in the appropriate unit price Bid Items. The re-grassing or re-sodding of property disturbed by the Contractor as well as the restoration of the landscaping and structures shall be part of the Contractor's unit price bid amounts under the appropriate items.

G. Unforeseen Utility Conflicts And Site Conditions

   i) The Owner's Allowance includes payment for relocating utilities or other structures not shown on the Drawings, or reasonably anticipated based upon a pre-bid inspection of project conditions and the work site; additional work to resolve unforeseen utility conflicts; or demolishing

structures not shown on the Drawings.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED**)**

END OF SECTION 01210

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Preparing and processing of submittals for review and action.
   2. Preparing and processing of informational submittals.

B. Submit the following for the **County's** review and action:
   1. Shop drawings
   2. Product data
   3. Samples
   4. Submittals indicated as "for approval"

C. Submit the following as informational submittals:
   1. Structural design information required by the contract documents
   2. Certificates
   3. Coordination drawings
   4. Reports
   5. Qualification statements for manufacturers/installers
   6. Submittals indicated as "for information only"

D. Specific submittals are described in individual sections.

E. Do not commence Work that requires review of any submittals until receipt of returned submittals with an acceptable action.

F. Do not allow submittals without an acceptable action marking to be used for the project.

G. Submittals shall be submitted to the **County** using the **County's** Document Tracking and Control System (DTCS) as outlined in **Section 01350 – Project Document Tracking and Control System**. No email submittals shall be allowed for approval. One copy of each submittal shall be uploaded by the **Contractor** into the software program named by the **County**. The **County** may determine that certain submittals also shall be submitted in hard copy form.

1.02 DEFINITIONS

A. "Shop drawings" are drawings and other data prepared by the entity that is to do the Work, specifically to show a portion of the Work.

B. "Product data submittals" are standard printed data that show or otherwise describe a product or system, or some other portion of the Work.

C. "Samples" are actual examples of the products or Work to be installed.

D. "Informational submittals" are those identified in the Contract Documents as for information only.

1.03 FORM OF SUBMITTALS

A. Submittals shall be uploaded to the **County's** DTCS in PDF format unless otherwise specified by the **County**.

B. If the County requests a submittal in hard copy, then the following formats apply:

1. Sheets larger than 8-1/2 by 14 Inches:
   a. Maximum sheet size: 24 by 36 inches (except for full-size pattern or template drawings).
   b. Number of copies:
      (1) Submittals for review: Three blue or blackline prints
      (2) Informational submittals: Three blue or blackline prints

2. Small sheets or pages:
   a. Minimum sheet size: 8-1/2 by 11 inches
   b. Maximum sheet size for opaque copies: 11 by 17 inches
   c. Number of copies shall be the same as for larger sheets

3. Samples:
   a. Two sets of each shall be submitted with the original submittal.
   b. One set shall be returned.
   c. If additional sets are needed by other entities involved in Work represented by the samples, these shall be submitted with original submittal.

1.04 COORDINATION OF SUBMITTALS

Coordinate submittals and activities that shall be performed in sequence or of different types for the same product or system so that the **County** has enough information to properly review each submittal.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 TIMING OF SUBMITTALS

A. Transmit each submittal at the time indicated on the approved construction schedule.

B. Deliver each submittal requiring approval in time to allow for adequate review and processing time, including resubmittals if necessary; failure of the **Contractor** in this respect shall not be considered as grounds for an extension of the contract time.

C. Deliver each informational submittal prior to start of the Work involved, unless the submittal is of a type that cannot be prepared until after completion of the Work; submit promptly.

D. If a submittal must be processed within a certain time in order to maintain the progress of the Work, state so clearly on the submittal.

E. If a submittal must be delayed for coordination with other submittals not yet submitted, the **County** may, at its option, either return the submittal with no action or

notify the **Contractor** of the other submittals that shall be received before the submittal can be reviewed.

3.02 SUBMITTAL PROCEDURES - GENERAL

A. **Contractor** review: Sign each copy of each submittal certifying compliance with the requirements of the contract documents.

B. Notify the **County**, in writing and at time of submittal, of points upon which the submittal does not conform to the requirements of the contract documents, if any.

C. Preparation of submittals:
   1. Label each copy of each submittal with the following information:
      a) Project name
      b) Date of submittal
      c) **Contractor's** name and address
      d) Supplier's name and address
      e) Manufacturer's name
      f) Specification section where the submittal is specified
      g) Numbers of applicable drawings and details
      h) Other necessary identifying information
   2. Submittals to receive **County's** action marking: Provide blank space on the label or on the submittal itself for action marking: minimum 4 inches wide by 5 inches high.

D. Transmittal of submittals:
   1. Submittals shall be accepted from the **Contractor** only.
   2. Submittals received without a transmittal form shall be returned without review or action.
   3. Transmittal form: The **Contractor** shall use a form acceptable to the **County**, with space provided on the form for:
      a) Project name
      b) Submittal date
      c) Transmittal number
      d) Specification section number
      e) To:
      f) From:
      g) **Contractor**'s name
      h) Subcontractor's and supplier's names
      i) Manufacturer's name
      j) Submittal type (shop drawing, product data, sample, informational submittal)
      k) Description of submittal
      l) Action marking
      m) Comments
   4. The **Contractor** shall complete a separate transmittal form for each submittal, also including the following:
      a) Other relevant information
      b) Requests for additional information
      c)

3.03 SHOP DRAWINGS

A. Content: Include the following information:
    1. Dimensions, at accurate scale
    2. All field measurements that have been taken, at accurate scale
    3. Names of specific products and materials used
    4. Details, identified by contract document sheet and detail numbers
    5. Compliance with the specific standards referenced
    6. Coordination requirements, including the relationship to adjacent or critical Work
    7. Name of preparing firm
    8. Design calculations

B. Preparation:
    1. Reproductions of contract documents are not acceptable as shop drawings.
    2. Copies of standard printed documents are not acceptable as shop drawings.
    3. Documents shall be identified as indicated for submittals.
    4. Space for **County's** action marking shall be adjacent to the title block.

3.04 PRODUCT DATA

A. Submit product data submittals for each system or unit of Work as one submittal.
B. When product data submittals are prepared specifically for this Project (in the absence of standard printed information), submit such information as shop drawings, and not as product data submittals.
C. Content:
    1. Submit manufacturer's standard printed data sheets.
    2. Identify the particular product being submitted; submit only pertinent pages.
    3. Show compliance with properties specified.
    4. Identify which options and accessories are applicable.
    5. Include recommendations for application and use.
    6. Show compliance with the specific standards referenced.
    7. Show compliance with specified testing agency listings; show the limitations of their labels or seals, if any.
    8. Identify dimensions, which have been verified by field measurement.
    9. Show special coordination requirements for the product.

3.05 SAMPLES

A. Samples:
    1. Provide samples that are the same as the proposed product.
    2. Where selection is required, provide the full set of options.

B. Preparation:
    1. Attach a description to each sample.
    2. Attach name of manufacturer or source to each sample.
    3. Where compliance with specified properties is required, attach documentation showing compliance.
    4. Where there are limitations in availability, deliveries, or other similar characteristics, attach descriptions of such limitations.
    5. Where selection is required, the first submittal may be a single set of options; after return of submittal with selection indicated, submit standard number of sets of selected item.

C. Keep final sample set(s) at the Project Site, available for use during progress of the Work.

3.06 REVIEW OF SUBMITTALS

A. Submittals for approval shall be reviewed, marked with appropriate action, and returned. Submittals are reviewed for conformance with project design concept and for compliance with standard of quality established in the Contract Documents. This review shall not relieve the **Contractor** from responsibilities for correctness of detail and dimension, nor from deviation from Contract Document requirements, except as noted and accepted in writing by the **County** at the time of submittal.

B. Informational submittals shall be reviewed.

C. Action markings for submittals for approval shall be as follows:
   1. NO EXCEPTIONS TAKEN (NET): Indicate that the submitted item is released for manufacture
   2. MAKE CORRECTIONS NOTED (MCN): Indicate that the submitted item is released for manufacture with the submittal complying with the comments
   3. AMEND AND RESUBMIT (AAR): Indicates that the submittal shall be revised or a new submittal complying with the comments made shall be prepared.
   4. REJECTED (REJ): Indicates that the submitted item does not comply with contract requirements and that another selection shall be made and the submittal process repeated.
   5. SUBMIT SPECIFIED ITEM(s) (SSI): Indicates that the submittal shall submit specified item(s) based on the specifications or as stated by the **County**

3.07 RETURN, RESUBMITTAL, AND DISTRIBUTION

A. Submittals shall be returned to the **Contractor** through the DTCS.

B. The **Contractor** shall address resubmittals in the same manner as original submittals, with changes other than those requested by the **County,** clearly indicated.
   1. Exception: Transmittal number for resubmittal shall be the number of the original submittal plus a letter suffix.
   2. Resubmittals shall be submitted within 14 days of **Contractor's** receipt of rejected submittal.

C. Distribution: The **Contractor** shall make one copy for project record documents and file in the DTCS.

END OF SECTION

SECTION 01310

CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.01 SUMMARY

Section includes progress documentation requirements.

1.02 SUBMITTALS

The Initial Baseline Schedule shall be submitted to the **County** within 15 calendar days after NTP. The final baseline schedule is to be submitted to the **County** within 15 calendar days after receiving comments from the **County** on the Initial Baseline Schedule. After receiving acceptance of the Baseline Schedule, the **Contractor** shall submit Progress Schedule Updates along with the Monthly Application for Payment.

1.03 FORM OF SUBMITTALS

A. Schedules - General:
   1. Provide legend of symbols and abbreviations for each schedule.
   2. Use the same terminology as that used in the contract documents.

B. Format - Bar Chart:
   1. Provide individual horizontal bars representing the duration of each major activity.
   2. Coordinate each element on the schedule with other construction activities.
   3. Show activities in proper sequence, including submittals, equipment delivery, materials delivery, installation, Progress Meetings, Progress Payments, testing, and any other level of effort activity such as General Conditions.
   4. Include the budgeted total cost, actual total cost, remaining total cost, and at completion total cost.
   5. Use vertical lines to mark the time scale at not more than 1-week intervals.
   6. Use sheets of sufficient number and width to show the full schedule clearly.
   7. Use Critical Path Methodology, resource/cost loading while developing the schedule. Tasks on the critical path shall be indicated in RED.
   8. Prior to creating the baseline schedule the **Contractor** shall coordinate with the **County's** representative to identify the required Work Breakdown Structure, Resource Dictionary, and Activity Codes to be utilized on said schedule.

C. Copies: Submit a minimum of two copies.

PART 2 – PRODUCTS

2.01 SOFTWARE / PROGRAMS

Schedules shall be prepared in Primavera P6 or, with **County** approval, Microsoft Project.

PART 3 - EXECUTION

3.01 PROGRESS SCHEDULE

A. Prepare and submit Progress Schedule.

B. Provide Progress Schedule in the form of bar charts.

C. The **County** will promptly review the schedule and notify the **Contractor** of acceptability. If schedule is not satisfactory, the **Contractor** shall revise and resubmit within 3 days.

D. Make and distribute copies of accepted schedule to the **County**, to subcontractors, and to other entities whose Work will be influenced by schedule dates.

E. Update the schedule whenever changes occur or are made, or when new information is received, but not less often than at the same intervals at which applications for payment are made. Payments may be withheld if schedule updates are not submitted as required.

F. The initial schedule and update information shall be provided by the **Contractor**. This information is a representation of the best efforts of the **Contractor** and its subcontractors as to how they envision the Work to be accomplished. Similarly, progress information to be provided by and through the **Contractor** shall be an accurate representation of its or its subcontractors' or suppliers' actual performance. The schedule shall remain an accurate reflection of the **Contractor's** actual or projected sequencing of Work. Once accepted, adherence to the established schedule shall be obligatory upon the **Contractor** and its subcontractors for the Work under this Contract. The **County** may require the **Contractor** to revise the schedule if, in its judgment, the schedule does not accurately reflect the actual execution of the Work, or is in violation of any provision on this scheduling specification. The **Contractor** shall revise the schedule as often as is required or necessary during the course of performance of the Work without additional cost to the **County**.

G. On a weekly basis, the **Contractor** shall submit a Two Week Look-Ahead schedule. This schedule will filter out work completed one week prior to the current data date, and two weeks after the current data date; and submitted to the **County** in both PDF and XER format.

3.02 PROGRESS OF WORK

A. The Work shall be started on the date indicated in the Notice to Proceed coinciding with the accepted baseline schedule 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, as to assure completion of the Work in the time established by the Contract. Additionally, the **Contractor** shall schedule and direct Work so to provide an orderly progression of the Work to completion within the specified Contract Time.

B. The **Contractor** agrees that whenever it becomes apparent from the current accepted monthly schedule update, that delays to the project have resulted and these delays are through no fault of the **County,** and hence, that the Contract completion date will not be met, or when so directed by the **County,** the

Contractor shall take some or all of the following actions at no additional cost to the **County.**

1. Increase Work force in such quantities and crafts as shall substantially eliminate the backlog of Work.
2. Increase the number of working hours per shift; shifts per working day, or days per week; the amount of construction equipment, etc., or any combination of the foregoing to substantially eliminate the backlog of Work. County to be compensated by Contractor for additional costs required to support increased hours and weekend work. Costs include but not limited to additional Construction Management and Construction Inspection.
3. Schedule activities to achieve maximum practical concurrence of accomplishment of activities, and comply with the revised schedule.
4. The **Contractor** shall submit for reviewing a written statement of the steps it intends to take, to remove, or arrest the delay to the schedule. If the **Contractor** fails to submit a written statement of the steps it intends to take or fails to take such steps as required by the Contract, the **County** may direct the level of effort in workforce (trades), equipment, and Work schedule (overtime) to remove or arrest the delay to the project in the accepted schedule, and the **Contractor** shall promptly provide such level of effort at no additional cost to the **County**. In addition, should schedule delays persist; the **Contractor's** bond agent shall be asked to attend meetings to update the schedule.

C. Failure of the **Contractor** to comply with the requirements of this provision shall subject it to, at the **County's** sole discretion, withholding, in partial or in total, payments otherwise due the **Contractor** for Work performed under this Contract. The **Contractor** agrees that any withholding of moneys is not a penalty for noncompliance, but is an assurance for the **County** that funds shall be available to implement these requirements should the **Contractor** fail to do so, since failure of the **Contractor** to comply with these requirements shall mean that the **Contractor** failed to execute the Work with such diligence as to ensure its completion within the time for completion.

END OF SECTION

SECTION 01350

PROJECT DOCUMENT TRACKING AND CONTROL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. The **Contractor** shall utilize the **County**'s Project Document Tracking and Control System (DTCS). The primary function of the system is to facilitate timely processing and approval of contract documentation in coordination with the overall Project Schedule established by these Specifications and the **Contractor**. The **Contractor** shall utilize this system for document tracking and control. The software will:

1. Facilitate communication between the **County** and **Contractor**.
2. Support turnaround time with regard to responses and approvals.
3. Provide a central location for Project information to support Project participants in performing their tasks based on the latest Project data.
4. Provide a standard system of project administration with accountability.

B. The **Contractor** shall utilize the web-based system that resides on the DWM server to generate documents in the proper format for submission to the **County**. The **Contractor** shall access the system using a compatible web browser from the **Contractor's** administrative field office location, and/or other locations where Work associated with the Project is being performed.

C. The **Contractor** shall be required to generate Project documents and records utilizing the aforementioned system. The **Contractor** shall be required to transmit and submit the Project documents within the system to the **County**.

D. The **Contractor** shall utilize a high-capacity scanner capable of scanning 24 x 36 documents, double-sided, onsite for the entire duration of the Project. Documents shall be scanned in and attached to the appropriate Contract Manager document, including submittals, shop drawings, operations & maintenance manuals, and other documents requested by the **County**.

E. The **Contractor** shall utilize the document control system to create and maintain Project documents, including, but not limited to the following:

1. Company Directory: Addresses, Phone Numbers, Personnel Contacts, etc.
2. Drawings Log: Current Drawing revision log
3. Submittals Integrated with Project Schedule through Activity codes
4. Transmittals
5. Risk Register
6. Requests for Information (RFIs)
7. Requests for Proposal (RFPs)
8. Work Authorization Requests (WARs)
9. Work Authorizations (WAs)
10. Change Order Requests (CORs)

11. Change Orders (COs)
12. Daily Reports (Daily Diaries)
13. Field Decisions, Field Orders (FOs), and Clarification Memos
14. Notice of Non-Compliance
15. Construction issue memos
16. Punch lists
17. Meeting Minutes and agendas
18. Correspondence
19. Work Plans
20. Startup Plans
21. Equipment Operations & Maintenance training
22. Spare parts lists

F. The **Contractor** shall utilize the complete capabilities of the DTCS to meet the requirements of this Section. The **Contractor** shall provide a highly trained and experienced construction project controls person knowledgeable in construction Work sequencing, productivity, scheduling, and application of the Primavera P6 software system. This person, along with the **Contractor**'s management team, shall work closely with the **County** to deliver the documents outlined in this Section.

G. Software Support

The **Contractor** shall be required to establish an internet connection using DSL or better to connect to the DTCS to permit the forwarding and receipt of documents.

H. The **Contractor** shall meet with the **County** within 15 days after the Contract is awarded to discuss access requirements and the **Contractor's** plan to utilize DTCS and execute the document control functions herein.

I. Access through the internet to the DTCS shall be operational within 30 days following the pre-construction meeting date. This shall be operational from the **Contractor's** administrative field office location.

1.02 COMPANY DIRECTORY

The **Contractor** and the **County** shall monitor and manage the Company Directory. The directory shall include Company name, Company abbreviation, contact names, address, phone numbers, and e-mail addresses.

1.03 DRAWING LOG

The **County** will maintain a log of initial "issued for construction" drawings in the DTCS. Information shall include drawing number, title and revision number. In addition to logging the initial project drawing list, the **County** will maintain a log on the DTCS of subsequent revisions to these drawings and any sketches resulting from clarification memos, RFPs, WARs, WAs, RFIs, Field Orders, and Change Orders (COs). It shall be the **Contractor's** responsibility to utilize the latest drawings and

sketches in the performance of the Work.

1.04 SUBMITTALS/SHOP DRAWINGS

A. Requirements: This section specifies supplemental requirements to GR-24 and **Section 01300 - Submittals**, related to the processing of submittals and shop drawings. The Contractor shall utilize the DTCS to log and track submittals, as well as generate associated transmittal letters.

B. Submittals and Product Data: A list of required submittals shall be entered into the DTCS by the Contractor. Submittals shall be incorporated into packages, with numbering as follows: XXXXX-YYY, where X denotes the applicable specification section and Y denotes the individual submittal number for that particular specification section, beginning with 001.The Contractor shall log and track submittals utilizing the DTCS. Each review cycle shall be entered into the DTCS. The Contractor shall identify as activities in the CPM schedule, to include data submittals, as well as those involving complex reviews and long lead deliveries, and procurement items required for construction activities. Submittal schedule information shall be updated monthly with the Contractor's updated project CPM schedule.

C. Samples: A list of required sample submittals shall be entered into the DTCS by the Contractor. Sample submittals shall be identified as individual submittals within the submittal packages, with numbering as specified above.

D. Guarantees/Warranties: A list of required Guarantee/Warranty submittals shall be entered into the DTCS by the Contractor. These submittals shall be identified as individual submittals within the submittal packages with numbering as specified above.

E. Work Plans, Startup Plans, O&M Submittals, and Spare Parts: Testing, Startup, and O&M submittals shall be entered into the DTCS by the Contractor. These submittals shall be identified as individual submittals within the submittal packages identified with numbering as specified above.

F. Submittal Procedures: The Contractor shall prepare submittal packages utilizing the submittal numbering system, description, and packaging conventions described above. Submittals prepared by the Contractor that fail to follow the conventions described above, will be returned "amend and resubmit." Should the Contractor determine that a submittal is required and is not covered by the listing within the DTCS, the Contractor shall consult with the County to determine the submittal number, description, and packaging that shall be required.

1.05 CORRESPONDENCE

The **County** shall monitor and manage the correspondence, Non-Compliance Notices, Field Decisions and Clarification Memos, and Construction Issue Memo logs. The **Contractor** shall generate Project correspondence within the DTCS, and forward the correspondence to the **County**.

1.06 TRANSMITTAL LOG

The **Contractor** and the **County** will monitor and manage the transmittal log. Project transmittals shall be created electronically, automatically sequentially numbered, and logged into the DTCS system as

they are created. The **Contractor** shall utilize the system to create transmittals for items transmitted to the **County**, Resident Inspection Staff, and other contractors.

1.07 RISK MANAGEMENT PLAN AND RISK REGISTER

Contractor shall provide a detailed and specific description of their approach to the management of risks associated with the Project, including permitting, design, construction, and testing and the **County's** operation and maintenance of the Project. Such risks shall include those allocated under the Contract to the County as well as those allocated to the **Contractor**.

Contractor is to develop and maintain a Risk Management Plan that can be used by the **County** to understand and evaluate the **Contractor's** understanding of the biggest risks and challenges to the Project, and how it intends to mitigate such risks. The **Contractor** shall provide sufficient information to enable the **County** to understand this evaluation. The Risk Management Plan shall include:

A. A detailed risk register that identifies Project risk, the likelihood of such risk manifesting itself on the Project, the severity of such risk and a mitigation plan for such risk.

B. An identification of and elaboration upon features of the **Contractor's** Design (if Design-Build type delivery) and Construction Plan that the **Contractor** considers unique and/or innovative relative to reducing or eliminating Project risk.

The **Contractor**, **County and Construction Manager** will review the Risk Register during the Project's progress meetings. The **Contractor** shall update the project Risk Register and provide these updates to the project team through the DTCS system on a monthly basis.

1.08 REQUESTS FOR INFORMATION & ANSWERS

The **Contractor** shall be responsible for generating RFIs on the DTCS system. The **Contractor** shall notify the **County** when an RFI is submitted. The **County** will monitor and manage the RFI log. The **County** will generate an Answer document in response to each RFI and forward them to the **Contractor**. The DTCS shall track "Ball in Court" for RFIs and Answers, as well as date of original generation and response date. In addition, the RFIs shall reference the relative Specification Section and Drawings. The DTCS shall identify the date of the request and the originator, responsible party for a response and the date of the response.

1.09 CHANGE DOCUMENTS

Change documents include Request for Proposals (RFPs), Work Authorization Requests (WARs), Work Authorizations (WAs), Change Orders Requests (CORs), and Change Orders (COs). Change documents will be monitored and managed by the **County** utilizing the DTCS. The DTCS shall track "Ball in Court" status of change documents.

1.10 DAILY REPORTS

The **Contractor** is responsible for creating daily reports (daily diaries) utilizing the DTCS. The **Contractor** shall enter the Daily Reports into the DTCS by 10:00 a.m. of the subsequent day that the **Contractor** or any subcontractor performs Work. Daily reports shall be logged into the DTCS by the **Contractor**. The **Contractor** shall also provide one signed hard copy of daily reports on a weekly basis. Required information shall include the **Contractor**, Date, Day, Temperature, Precipitation, Sky, Wind, Work Activity, Equipment, Field Force, Visitors, Materials, and Scheduled Activities utilizing the

Primavera schedule activity codes. Daily reports that fail to link Work activities to the active Project schedule shall not be acceptable.

1.11 PUNCH LISTS

The **County** will monitor and manage punch lists, and will create punch lists to be forwarded to the **Contractor**. The **Contractor** shall address the punch list items that have been assigned to the **Contractor** and forward updates to the **County**. Once accepted as complete, the **County** will access the punch list in the DTCS and close it out.

1.12 MEETING MINUTES AND AGENDA

The **County** will monitor and manage the meeting minute process. The **County** will forward meeting minutes to the **Contractor** electronically. The **County** will log the meeting minute items into the DTCS within 3 days of the meeting date.

1.13 PROGRESS PAYMENTS /REQUISITIONS FOR PAYMENT

The **Contractor** is responsible for creating progress payment applications directly from the project scheduling software and then forwarding them to the **County** electronically, along with hard copies, by 4:00 p.m. at the end of each update/billing period. The **Contractor** shall also simultaneously provide a separate submittal of the updated progress schedule (P6 or latest version at the time of purchase), as specified in **Section 01310 - Construction Schedule**, Schedule of values shall be developed as defined in **Section 01310 - Construction Schedule** within the Pay Application and shall be coordinated with the **County**'s Project Manager. Maintenance of the "As-Built" record documents by the **Contractor** shall be verified before processing shall be approved. Failure of a **Contractor** to maintain project record documents, maintain current and properly prepared daily reports, or submit the project schedule update per **Section 01310 - Construction Schedule** shall be just cause for withholding the monthly or final payment.

END OF SECTION

SECTION 01351

PUBLIC OUTREACH

PART 1 - GENERAL

1.01 SCOPE

Public outreach related to the Project shall be directed and led by the **County**'s DWM Public Outreach Office (DWMPOO), through a public communications and outreach specialist (PCOS) assigned by the **County**. The **Contractor** shall assist and support the **County**'s PCOS by ensuring that a nominated **Contractor** employee is available and trained to support the outreach efforts as specified herein.

1.02 STAFFING

A. The **Contractor** shall designate a public outreach contact (POC) on the construction crew to continuously coordinate and provide information regarding customer service issues at the project site to the **County's** construction manager, who will notify DWMPOO and PCOS.

1. The POC shall have responsibility for coordinating with the PCOS in receiving, logging, tracking, responding, and resolving customer/citizen complaints and Claims, providing notices to and personal interaction with affected customers/citizens at the site regarding project impact and projected work schedules.

2. The POC shall have the responsibility of reporting to the PCOS any unforeseen construction incidents with the potential to impact community quality of life and updating and coordinating with PCOS to implement appropriate responses and/or, notifications to and personal interactions with affected customers/citizens.

3. The POC shall participate in an orientation session presented by DWMPOO focusing on established protocols and procedures for conducting on-site public outreach activities during construction.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 PUBLIC INFORMATION KICK-OFF MEETING (AT DWM DISCRETION)

A. Prior to commencement of Work under the Contract and following the preconstruction meeting, the **Contractor**, the PCOS, and the **County** shall attend a meeting hosted by the DWM project manager (PM) or construction manager (CM). At this meeting, the **Contractor**'s responsibilities and the relationship with the DWMPOO and PCOS and the functions and responsibilities of the POC employed by the **Contractor**, according to Section 1.02 A, will be discussed. The **Contractor**'s PCand backup individual(s) shall be identified to the DWM's call center, DWMPOO and PCOS, with 24/7 contact telephone numbers provided.

3.02 RESPONSIBILITIES OF THE POC

A. The duties of the **Contractor's** POC shall be as defined below and may be expanded by the **County's** construction manager.

1. Coordinating with PCOS for the logging, tracking, and resolving customer/citizen complaints and Claims, when received by the **Contractor**, and providing periodic updates and reports as specified.

2. Working with PCOS to develop and implement a plan for providing notice to affected customers/citizens in the event there are scheduled service outages or other Work elements required for the performance of Work under the Agreement that are scheduled that shall have an impact on the neighborhood or property owners, and executing the plan once approved by DWMPOO.

3. Attending and participating in scheduled Project progress meetings for discussion, updates, review of complaints log and potential resolution to customer/citizen complaints, Claims, review of schedules, and other matters, as required.

4. Planning, attending and participating in periodic public meetings and working with the DWMPOO to promote and prepare necessary Project information in advance of these meetings.

In the event Work is required on private property where an easement has been acquired, the POC shall assist the PCOS in notifying the property owner at least fourteen (14) days in advance of commencement of the Work, in writing, with a copy provided to the DWMPOO. In no case will customers/citizens be contacted by **Contractor** without DWMPOO approval of both the communication plan and of any literature provided to customers/citizens.

Prior to commencement of work in neighborhoods, the POC shall work with the PCOS to notify the customers/citizens fourteen (14) to thirty (30) days in advance. In no case will customers/citizens be contacted by **Contractor** without DWMPOO approval of both the communication plan and of literature provided to customers/citizens. In addition, 72 hours prior to actual commencement of the work, the PCO shall notify the customers/citizens via door hangers as hereinafter provided for in this Section. Such notices shall be coordinated with the **County**'s Construction Manager and Public Outreach Office.

The PCOS shall be responsible for managing those notifications within the context of the Project schedule and the approved Project procedures, in coordination with the POC. The POC shall assist the **County** Site staff with the resolution of public outreach-related items that might delay or disrupt the Project work.

In the event the POC is away from Work, the **Contractor** shall designate a second individual, who shall be fully familiar and aware of the duties and prosecution of the Work, to handle the outreach coordination responsibilities and functions.

The POC shall assist the DWMPCOS in coordination of communications related to street closures, detours, and traffic pattern changes with the **Contractor**'s field management staff, the **County**'s construction manager, and the Department of Public Works or the GDOT.

In the event there is an emergency involving the public or a situation where media inquiries and responses are possible, the POC shall notify the **County**'s DWMPCOS immediately. The DWMPCOS will then coordinate with the **County**'s public relations/media relations manager for appropriate action. **Under no circumstance and at no time shall the Contractor or any of its employees, Subcontractors or vendors of the Contractor make comments to the media regarding the Project**.

3.03 ISSUES MANAGEMENT TRACKING

A The **County** shall develop, implement, and maintain an organized and comprehensive issues management strategy for tracking customer/citizen complaints, Claims, and inquiries. Related information shall be updated on a daily basis by the PCOS with input from the **Contractor**'s POC. Tracking information and responses shall be coordinated with the DWMPOO.

B Information recorded shall include, but not be limited to, the following:

1. Date complaint/claim/inquiry received
2. Name, address and telephone number of individual filing complaint/claim/inquiry
3. Nature of complaint/claim/inquiry
4. Address where problem is located if different than above
5. Action required, date, action taken, date action completed
6. Follow-up with person who filed under number two (2) above, to verify satisfaction or status
7. Documents associated with actions taken
8. Any information regarding resolution with the **Contractor's**, Subcontractor's, or vendor's insurance company shall be fully documented

In no case will customers/citizens be contacted by **Contractor** without DWMPOO approval of both the communication plan and of literature provided to customers/citizens.

3.04 DOOR HANGERS

The **Contractor** shall produce door hangers required for notice to customers/citizens and residents from the template provided by the **County**'s DWMPOO (see example at the end of this Section) as specified above in paragraph 3.02. Door hangers shall be utilized for notification in event of, but not limited to, the following events:

A. Planned service disruption/outages

B. Road closures/detours/traffic pattern changes

C. Access/entrance to property

D. Work startup

E. Smoke testing

F. Blasting

The DWMPCOS shall be notified twenty-four (24) hours in advance of any door hanging activity by the **Contractor**.

Sample 1. Door Hanger

3.05 IMPACTED AREA ADDRESS DATABASE

A. The **Contractor** shall provide the DWMPCOS with a database of addresses and phone numbers (and names if available) of Project-affected residences, businesses, and facilities at least three (3) weeks prior to Project startup. The database will be used by the DWMPOO for regular citizen communications and notifications.

B. The **Contractor** shall copy the DWMPCOS on correspondence and Right-of-Entry Agreements with citizens and property owners.

3.06 SCHEDULE

A. The **Contractor** shall provide the DWMPCOS with a copy of the detailed Project schedule following approval by the **County**.

B. Biweekly, the **Contractor** shall provide a list of properties:

1. That shall be affected by the **Contractor**'s activities within the upcoming four (4) weeks.

2. Where work is ongoing in the right of way in front or in the back of the property.

3. Where site restoration activities are ongoing.

C. The **Contractor** shall inform the PCOS through the weekly progress meetings and in writing of Project schedule changes or changes in disruptive work, such as blasting and road closures that would have significant impact on citizens or require prior citizen notification.

3.07 MEDIA RELATIONS AND JOB SITE INQUIRIES

A. As specified above in paragraph 3.01, only authorized persons with the **County** shall release information in response to media inquiries. The **Contractor**'s field personnel shall keep Project information cards available that shall be provided to media and citizens if inquiries are made onsite. Media and citizen inquiries shall be directed to the DWPCOS via the Project information email or phone line.

B. Project information cards shall be produced from the template provided by the public outreach team.

3.08 NOTIFICATIONS

The **Contractor** shall provide the following notifications to the DWMPOO to facilitate its communication with affected citizens through hand-distributed flyers or mailers:

A. Anticipated work start date – notify at least four (4) weeks prior to start of construction so that DWMPCOS can send out mailers or door hangers two (2) weeks prior and/or distribute notification letters seventy-two (72) hours before construction begins.

B. Service disruptions - notify DWMPCOS at least two (2) weeks in advance so that door hangers can be produced and distributed at least seventy-two (72) hours prior to the start of disruption.

C. Full Road Closure - notify DWMPCOS at least three (3) weeks in advance so that door hangers or notification letters can be produced and distributed at least seventy-two (72) hours prior to the start of closure, preferably two (2) weeks before closure goes into effect.

D. Significant work in a neighborhood: Blasting, directional drilling, trenchless installation, and open cut shall require letter or door hanger notification of the DWMPCOS at least seventy-two (72) hours in advance.

E. The **Contractor** shall provide the following door hanger notifications and the personnel to deliver them, at a minimum:

1. Service disruptions: notice to citizens seventy-two (72) hours prior to disruption.

2. Full street or partial closure: Notify fire, police, other emergency services, and other authorities seventy-two (72) hours prior to street closure, preferably two (2) weeks in advance for full closure.

3. Significant work in neighborhoods: such as Blasting, directional drilling, and trenchless installation, or open cut, etc.: Notify citizens via door hangers or letters seventy-two (72) hours in advance.

F. The **Contractor** shall be fully responsible for notification to emergency-related services for detours, closures (partial or full) or traffic pattern changes and shall be detailed in their traffic control plan and implemented through the **Contractor**'s traffic control manager and per permitting requirements.

G. The **Contractor** shall be fully responsible for distributing notifications a minimum of seventy-two (72) hours in advance of service outages for schools, nursing homes, hospitals, medical clinics, assisted living facilities, or other types of facilities. **Contractor** shall make personal contact with facility representatives no later than sixty (60) minutes prior to the outage.

H. The **Contractor** shall at all times coordinate with the DWMPCOS and call center to provide detailed schedules and street locations for service disruptions or street closures to verify that DWM customer service call center is well equipped to provide adequate response to citizen inquiries.

3.09 RESOLUTION OF COMPLAINTS AND CLAIMS

A. Failure of the **Contractor** to resolve any legitimate complaint or Claim filed resulting from the Work performed under this Contract, following notice in accordance with the General Requirements, shall result in resolution of the complaint or Claim by the **County**. The **Contractor** shall be charged for the associated cost in accordance with the applicable General Requirements of the contract. No additional payment shall be made to the **Contractor** for costs associated with complaint or Claim resolution, same being incidental to the various contract items that are Bid. Failure to manage the issues and items adequately to minimize public complaints and impacts shall be cause for increasing the retainage, withholding payment, or notice and termination of the **Contractor** for cause when more than ten (10) percent of the noticed complaints or Claims past thirty (30) days are without decisive resolution and scheduling of recovery Work.

END OF SECTION

SECTION 01380

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

The **Contractor** shall clearly document site conditions along the entire project site prior to the start and upon the completion of the project/contract by use of digital video recording. The cost of the photographic documentation shall be included in the Contract Price.

The **Contractor** shall submit monthly color progress photos along the entire line of the active Work site. Monthly record progress photographs shall be submitted with monthly payment requisition. Photographs shall document construction within roadways, rights-of-way, and easements,

The **Contractor** shall engage the services of an experienced professional photographer, approved by the **County**, to take videos, color photographs of the site as directed by the **County**.

1.02 PROCEDURES

A. The digital video recording and periodic still photographs shall be taken from identifiable reference points along the Work corridor. The same reference points shall be used through the life of the project/contract to achieve an accurate record of construction.

B. The **Contractor** shall adequately document areas of sensitivity such as landscaped areas, lake or stream banks, or areas surrounding existing structures.

C. Each photograph, video, or digital file of such submitted shall be dated, identified, and captioned, referencing the location, project name, project number, and pertinent information to clearly describe the scene.

D. Recording shall be done with adequate lighting. Written authorization by the **County** to proceed with video documentation at any areas shall be done with consideration of existing environmental conditions. The designee of the **County** will accompany the photographer during the video and photo sessions.

E. **Contractor** shall notify **County** of the time and place for video recording and digital photography. **Contractor** shall provide access and accommodation to the **County** representative during the photographic documentation process. The **County** reserves the right to reject any photograph that is not clear or definitive. Any photograph so rejected shall be subtracted from the total exposures required under this Contract.

F. The daily construction photographs shall be the permanent visual record of the pre-construction conditions, daily construction site activities, and the completion of construction Work. The **Contractor** shall submit to the **County** no fewer than four record photos for each activity ID listed in the project schedule per the last schedule update. Applicable photos shall accompany each Pay Application.

1.03 VIDEOS

A. The project corridor shall be documented by digital video recordings.

B. All digital video recordings shall be in color and shot with a 1080 HD (1920 x 1080) using MPEG-4 program stream encoding (ISO-IEC 14496-14) camera and shall be a clear, stable image with no interference. Black and white recordings shall not be accepted. The video shall be provided on Digital Video Discs (DVDs) or USB Flash Drives and shall conform to currently recognized standards for video recordings. Specifically, the recordings shall be in focus and properly illuminated with good contrast. The picture shall be clear and possess accurate color levels and balance (tint) without outside interference. All recordings shall also include a clear and distortion free audio narration that clearly identifies all, important features of the project, including stationing along pipeline construction, and is in synchronization with the video. The recording shall bear a continuous "date and time stamp" that is electronically recorded by the camera.

C. A record of the contents of each recording shall be provided on a run sheet, identifying each chapter segment of the recording. The run sheet shall be provided in paper copy as well as on the flash dive or hard drive.

1.04 PHOTOGRAPHS

A. The file format for digital photographs shall be Tagged Image File Format (TIFF).

B. Digital cameras shall produce records with true optical resolution. Images shall not be resized or interpolated to a higher resolution from a lower resolution.

C. Photographic images shall be provided as 8 bit per channel RGB color images.

D. Digital camera files shall be captured as 12 megapixel files or greater in size with a minimum pixel array of 5,000 pixels by 3,500 pixels.

E. One set of digital images shall be furnished on a DVD. All disks shall have a label that includes project information as well as the date, and whether these are pre-construction, construction, or post-construction photographs.

F. The information below shall be printed on a sheet of paper in a clear sleeve to be included in the binder holding the DVD+R. The information shall also be provided in a Microsoft Excel spreadsheet that shall be included on the DVD. Additionally, this information shall be embedded in each digital photo file using the IPTC/XMP (International Press Telecommunications Council's/Adobe Extensible Metadata Platform) Standard.

1. Project number
2. Project name
3. Contract number and description
4. Photo number
5. View and description, indicating:
    a) Location of camera
    b) General description of what the photograph represents

6. Whether this is a pre-construction, construction or post-construction photograph
7. Date picture was taken
8. Name of photographer
9. County witness

G. The **Contractor** shall transmit one electronic copy of each photo to the Engineer for use in preparing descriptions. The photos with descriptions will be returned to the **Contractor** for printing and mounting.

H. Binders shall be equipped with a pocket suitable for storing the photo DVDs. The materials shall meet the requirements of ISO 18902:2013 "Imaging materials - Processed Imaging Materials – Albums, Framing and Storage Materials."

1.05 SUBMITTALS

A. The **Contractor** shall furnish to the **County** for approval one copy of the video digital file taken of existing conditions prior to start of the Project and before the submittal of the first request for payment. The video digital file shall be assembled upon completion of the Project and shall be furnished to the **County** for approval prior to submittal of the final request for payment. No pay requests shall be processed before the submittal of the respective video records.

B. **Contractor** shall utilize **County's** Project Document Tracking and Control System to submit videos and progress photographs in electronic format for the duration of the project in accordance with **Section 01350 - Project Document Tracking and Control Systems**.

PART 2 - PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 USE OF PHOTOGRAPHS AND VIDEOS

A. Upon their creation, the photographs, prints, DVDs, and videos resulting from the Work under this Contract shall become the exclusive property of the **County**.

B. Neither the **Contractor** nor the photographer nor the video recording firm shall retain any rights pertaining to the photographs, prints, CDs/DVDs, or videos, nor shall they reproduce or otherwise publish or disseminate any of the photographs, aerials, prints, CDs/DVDs, or videos taken under this Contract without the prior written approval of the **County**.

C. The photographs, prints, CDs/DVDs, and videos shall be considered "Work made for hire" under applicable provisions of the Copyright Act, and the **County** shall be the copyright owner thereof and of the aspects, elements, and components thereof in which copyright protection might subsist. To the extent that such materials do not qualify as "Work made for hire," the **Contractor** hereby irrevocably transfers, assigns, and conveys exclusive copyright ownership in and to such materials to the **County**, free and clear of any liens, claims, or other encumbrances. The

agreements between the **Contractor** and the photographer and videotaping firm shall include a provision containing these requirements.

END OF SECTION

SECTION 01400

CONTRACTOR'S WORK QUALITY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. **Contractor**'s Quality Assurance / Quality Control Requirements

B. Experience and Qualifications of Supply and Service Companies

C. Quality of Materials, Equipment, and Work

D. Defective Work, Equipment, or Materials

E. Welding Certification and Welding Inspection

F. **Contractor**'s Surveyor

G. Field Measurements

1.02 PAYMENT

No separate payment shall be made for performing any Work of this Section and costs thereof shall be deemed incidental to the Work and included in the prices bid for the Contract, unless otherwise specified in the Detailed Specifications.

1.03 RELATED SECTIONS

Section 01410 - Testing Laboratory Services.

1.04 DESCRIPTION

A. Experience and Qualifications of Supply and Service Companies: The **Contractor** shall require subcontractors, materialmen, and equipment service providers to comply with the accepted Health, Safety & Security Plan, and Quality Assurance requirements under the Contract.

B. Quality of Materials, Equipment and Work

1. All materials, fixtures, fittings, supplies, and equipment furnished under this Contract shall be new, of standard first grade quality, of the best workmanship, correctly designed, and be intended for the use for which they are offered. Materials or equipment that, in the opinion of the **County**, are inferior or of a lower grade than indicated, specified or required, or are obsolete, shall not be accepted.

2. All Work of assembly, installation, and construction shall be done in a neat, first-class, and skillful manner. If the quality of the material, fixtures, fittings, supplies, equipment or Work required by the Drawings does not agree with that required by the Specifications, the better quality shall be supplied. In asking for prices on, or placing orders for, materials, fixtures, fittings, supplies, and equipment intended for use or installation under this Contract, the **Contractor** shall provide the manufacturer or dealer with such complete information from these Specifications as may in any case be necessary. In every case, it shall quote in full to each such manufacturer or dealer the text of this subparagraph, as well as the text of such other portions of the Specifications, as are appropriate.

3. At all times while Work under this Contract is being performed, the **County** shall have access to all parts of the **Contractor's** or manufacturers' plants or other locations where the forgings, plates, materials, fixtures, fittings, supplies, or any other articles required under this Contract are manufactured, assembled, tested, or inspected. The **County** shall be permitted to witness any or all of these operations, as the **County** may deem necessary to determine that the Work is being performed in accordance with the Specifications and the approved shop drawings. The cost, if any, of providing such access shall be considered part of the normal expense of conducting business and therefore non-reimbursable.

4. The **County** shall be furnished with full facilities for inspecting the Work and ascertaining that it is being done strictly in accordance with the requirements of the Specifications, Drawings, and the intent of this Contract.

5. The **Contractor** shall provide a suitable space for the **County** and the **County's** authorized representatives conveniently located near that part of each plant where materials or equipment to be furnished under this Contract are being manufactured, assembled, or shop tested. Each space shall be furnished with facilities for the making and the keeping of records and correspondence. The reasonable use of a photocopier, telephone, and fax shall be provided, as required by the **County**. Long distance communications shall be made using **County** mobile telephones at no cost to the **Contractor**.

6. The **Contractor** shall give notice in writing to the **County** sufficiently in advance of its intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction in the event that the **County** intends to perform Witness Shop Testing and Quality Assurance Inspection. Such notice shall contain the date of commencement and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, the **County** will: decide upon its intent to inspect the Work or notify the **Contractor** that inspection will be waived. In those instances where the **County** inspector(s)

arrive at the agreed-upon location, at the agreed-upon date and time, and find that the article(s) to be inspected are not ready for inspection, the inspector(s) shall return to their home office and the expenses incurred shall be borne by the **Contractor** and shall be deducted from the **Contractor**'s next payment, unless otherwise determined by **County**.

7. Inspection of the Work by the **County** is made solely for the benefit of the **County**. The inspection of the Work shall not relieve the **Contractor** of any of its obligations to fulfill the Contract as herein prescribed, and defective Work shall be repaired or replaced at the **Contractor**'s sole expense.

C. Defective Work, Equipment, or Materials

1. All defective or imperfect Work, equipment, or materials furnished by the **Contractor** that is discovered before the Final Acceptance of the Work, or during a warranty period, shall be removed immediately even though it may have been overlooked by the **County** and approved for payment. The **Contractor** shall repair such defect, without compensation, in a manner satisfactory to the **County**.

2. Unsuitable materials and equipment shall be rejected, notwithstanding that such defective Work, materials, and equipment may have been previously overlooked by the **County** and accepted or approved for payment.

3. If any workmanship, materials, or equipment are rejected by the **County** as unsuitable or not in conformity with the Specifications or Drawings, the **Contractor** shall promptly replace such materials and equipment with acceptable materials and equipment at no additional cost to the **County**. Equipment or materials rejected by the **County** shall be tagged as such and shall be immediately removed from the site.

4. The **County** may order tests of imperfect or damaged Work equipment, 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 shall be as determined by the **County**. If the results of the tests indicate that the required functional capability of the Work, equipment, or material was not impaired, the Work, equipment, or materials may be deemed acceptable, in the discretion of the **County**. If the results of such tests reveal that the required functional capability of the questionable Work, equipment, or materials has been impaired, then such Work, equipment, or materials shall be deemed imperfect and shall be replaced. The **Contractor** may elect to replace the imperfect Work, equipment, or material instead of performing the tests.

5. If, in the making of any test, it is ascertained by the **County** that the material or equipment does not comply with the Contract, the **Contractor** will be notified thereof, and it will be directed to refrain from delivering said material or equipment, or to promptly remove it from the site or from the Work and replace it with acceptable material without cost to the **County**. Upon rejection of any material or equipment submitted as the equivalent of that specifically named in the Contract, the **Contractor** shall immediately proceed to furnish the named material or equipment.

D. Welding Certification and Welding Inspection

1. For Work performed within the limits of the **County**, field welding required under this Contract shall be performed by certified welders:

   a. Certification for Welding – For field and shop welding, the following welding qualification provisions shall apply:

      i. For field welding, required permits and safety plans shall be in place and adhered to.

      ii. For shop welding: welding shall be performed in accordance with the relevant Work-specific requirements in the Specifications and Drawings.

      iii. If existing certification is not approved or not submitted, then the welders/welding shop/tack welders shall be qualified in accordance with the above procedures and tests, as administered by an inspection agency approved by the **County**. The costs associated with the required tests for certification and/or retests, if any, shall be borne by the **Contractor**. The **County** shall be given a notice of not less than 5 business days prior to such tests and may elect to witness any or all of these tests. The costs associated with witnessing these tests shall be borne by the **Contractor**.

   b. Any deviation from the above shall not be permitted without a written waiver from the **County** or its designee.

2. All welding, including welder certification, shall be performed in accordance with the requirements of AWS D1, ASME IX (and the applicable construction code), and as approved by the **County**.

3. Welding inspection shall be in accordance with the latest rules of the American Welding Society, and the following shall apply:

   a. All welds shall be inspected visually in accordance with Section V of the ASME Code.

b. All stainless steel partial penetration groove welds shall be inspected and approved by means of Liquid Penetrant Examination (PT) in accordance with Appendix 8 of Section VIII, Division 1 of the ASME Code. Welds failing the inspection shall be made good and re-inspected by PT.

c. All carbon steel partial penetration groove welds shall be inspected and approved by means of Magnetic Particle Examination (MT) in accordance with Appendix 6 of Section VIII, Division 1, of the ASME Code. Welds failing the inspection shall be made good and re-inspected by MT.

d. On full penetration welds, both the root pass and the final weldment shall be inspected by means of MT or PT as applicable.

e. Unless otherwise approved, inspection of welds shall be conducted by an inspection agency approved by the **County**.

f. Unless waived by the **County**, full-penetration welds shall be inspected by Radiographic Examination (RT) in accordance with ASME Code, Section VIII, Division I, Paragraph UW-51.

g. The **County** may elect to witness any or all of the welding inspection. Notice shall be given to the **County** not less than 5 business days prior to welding and inspection of those items specifically designated by the **County**. The costs associated with the welding inspection by the **County** inspectors and any additional testing required by the **County** shall be borne by the **Contractor**.

E. **Contractor**'s Surveyor

1. The **Contractor** shall retain the services of a licensed land surveyor to perform survey Work, including, but not limited to, establishing line and grade, in advance of the construction; and to perform other surveying services for the Work included under the Contract. The surveyor shall be subject to the approval of the **County**. Survey drawings shall be submitted to the **County** for approval.

2. The **Contractor** shall erect, install, and maintain survey platforms, targets, benchmarks, and similar facilities to be used by the **County** in the performance of its inspection services; and shall perform survey Work required before, during, and after construction.

F. Field Measurements

1. The Contractor shall take the necessary measurements in the field to determine the exact dimensions for Work and verify pertinent data and dimensions shown on the Contract Drawings

1.05 QUALITY ASSURANCE / QUALITY CONTROL PLAN

A. The **Contractor** shall establish and execute a Quality Assurance/Quality Control (QA/QC) Plan for the services and equipment that will be supplied under this Contract. The plan shall provide the **Contractor** with adequate measures for verification and conformance to defined requirements by its personnel and subcontractors, fabricators, suppliers, and vendors. The **County's** review and acceptance of the **Contractor's** QA/QC plan shall not relieve the **Contractor** from any of its obligations for the performance of the Work. The **Contractor's** assigned QA/QC personnel are subject to the **County**'s review and continued acceptance. No Work covered by the QA/QC plan shall start until the **County's** written acceptance of the **Contractor's** QA/QC plan has been obtained.

B. The **Contractor**'s quality control organization with lines of authority and reporting structure. The Construction Quality staffing shall include a Construction Quality Manager and a supporting staff as applicable to the project. The reporting structure shall clearly provide for direct reporting access by the Construction Quality Manager to the **Contractor**'s principal officers.

C. The names, qualifications (in resume format), duties, responsibilities, and authorities of the Construction Quality Manager and staff. Construction Quality personnel qualifications (in resume form), including copies of each member's applicable certificates of training and/or qualification.

D. A copy of a letter to the Construction Quality Manager signed by a principal officer of the **Contractor**'s firm that describes the responsibilities of the Construction Quality Manager and establishes his/her authority, including authority to stop Work that does not conform with the Contract Documents. The Construction Quality Manager shall issue letters of direction to other Construction Quality staff outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the CIP PMT and CM.

1.06 SUBMITTALS

A. Within 15 days after the commence Work date given in the Notice to Proceed (NTP), the **Contractor** shall provide its QA/QC plan to the **County** for approval. At a minimum, the plan shall consist of the following quality elements:

1. Responsibilities
2. Management and Production Instructions
3. Material Control
4. Marking and Material Identification
5. Setup and Operational Procedures

6. Non-Conformances

7. Painting

B. Additionally, when required by the **County**, the **Contractor** shall submit the following information prior to his entering into a supply or service subcontracts:

1. Contract number, supplies or services to be provided and a general description of the proposed item(s), such as trade name, type, etc.

2. The name and address of the manufacturer or service company and the location of the plant where supplies will be manufactured and tested as required, or at which the services will be performed.

3. Experimental and test data required to support the claimed performance of the supplies.

4. A description of the testing plant, including the hydraulic, electrical and other facilities, in sufficient detail to show that the plant is adequately equipped for performing the tests, if such testing is required.

5. All additional information that the **County** may deem necessary in order to determine the ability of the supply or service company to produce the item as called for by the Specifications.

PRODUCTS (NOT USED)

SECTION 2 - EXECUTION

2.01 QUALITY DEFICIENCY AND NON-CONFORMANCE DOCUMENTATION

Quality Deficiencies and Non-Conformances are defined as documentation, drawings, material, and equipment or Work not conforming to the specified requirements or procedures. The **County** will implement and maintain a three-tier non-conformance process, as follows:

A. Deficiency Notice (DN) – The lowest level of non-conformance reporting. It documents the deficient condition and provides the **Contractor** 72 hours, or before the Work is covered, to correct the issue before it is elevated to the next level of reporting. It is issued for deficiencies that can be easily corrected without an engineering resolution. An example would be incorrect formwork dimensions observed prior to placement of concrete.

B. Non-Conformance Report (NCR) - The second level is an NCR that documents deficient Work that has not been corrected, or that would require an engineering solution to remedy. NCRs shall be answered in writing by the **Contractor** within 24 hours. The **Contractor** shall not be allowed to progress items for payment if it has open NCRs.

C. Corrective Action Request (CAR) – The highest level of non-compliant reporting. CARs are issued for programmatic and repetitive non-compliant conditions. Examples of CARs would be using the wrong drawing revision in

the field (programmatic) and a condition where the same type of Work has multiple NCR issues over a short period of time (repetitive). CARs cannot be answered by the **Contractor** field staff. They shall be transmitted to the **Contractor**'s senior level management for response.

END OF SECTION

SECTION 01410

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 SCOPE

A. Testing shall be performed to determine that materials provided for the Work meet the specified requirements, in accordance with the requirements of the Specifications. Such testing includes, but is not necessarily limited to:

1. Cement
2. Aggregate
3. Concrete
4. Concrete block
5. Pipe
6. Steel and metals
7. Welding
8. Soil compaction
9. Bituminous pavement

B. Requirements for testing may be described in various sections of these Specifications; where no testing requirements are described, however if the **County** decides that testing is required to demonstrate compliance with specified material or performance standards, the **County** shall require testing to be performed under current pertinent standards for testing.

C. Employment of a testing laboratory shall in no way relieve the **Contractor** of its obligation to perform Work meeting the requirements of the Contract.

D. The independent testing laboratory shall be selected and paid by the **Contractor** and approved in writing by the **County** before any testing services are performed.

E. The **Contractor** shall pay directly for the services of the independent testing laboratory, approved by the **County**, for all testing required under this Contract.

1.02 LABORATORY DUTIES

A. Cooperate with **County** and **Contractor**.

B. Provide qualified personnel promptly on notice.

C. Perform specified inspections, sampling, and testing of materials and methods of construction.

1. Comply with specified standards, ASTM, other recognized authorities and as specified.
2. Ascertain compliance with requirements of Contract Documents.

D. Promptly notify the **County** and **Contractor** of irregularity or deficiency of Work that is observed during performance of services.

E. Promptly submit three copies (two copies to **County** and one copy to **Contractor**) of report of inspections and tests in addition to those additional copies required by the **Contractor,** including:

1. Date issued
2. Project title and number
3. Testing laboratory name and address
4. Name and signature of inspector
5. Date of inspection or sampling
6. Record of temperature and weather
7. Date of test
8. Identification of product and Specification section
9. Location of Project and test
10. Type of inspection or test
11. Results of test
12. Observations regarding compliance with Contract Documents

F. Perform additional services as required.

G. Laboratory shall not be authorized to:

1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of Work.

1.03 CONTRACTOR RESPONSIBILITIES

A. Cooperate with laboratory personnel; provide access to Work and/or manufacturer's requirements. Contractor shall not charge for downtime due to required testing.

B. Provide to laboratory, preliminary representative samples, in required quantities, of materials to be tested.

C. Furnish copies of mill test reports.

D. Furnish required labor and facilities:

1. To provide access to Work to be tested
2. To obtain and handle samples at the site
3. To facilitate inspections and tests
4. Build or furnish a holding box for concrete cylinders or other samples as required by the laboratory

E. Notify laboratory sufficiently in advance of operation to allow for the assignment of personnel and schedules of tests.

F. Laboratory Tests: Where such inspection and testing are to be conducted by an independent laboratory agency, the sample or samples shall be selected by such laboratory or agency or the **County** and shipped to the laboratory by the **Contractor** at **Contractor**'s expense.

G. Copies of the correspondence between the **Contractor** and testing agencies shall

be provided to the **County**.

1.04 QUALITY ASSURANCE

Testing, when required, shall be in accordance with all pertinent codes and regulations and with procedures and requirements of ASTM.

1.05 PRODUCT HANDLING

Promptly process and distribute all required copies of test reports and related instructions to insure all necessary retesting or replacement of materials with the least possible delay in progress of the Work.

1.06 FURNISHING MATERIALS

The **Contractor** shall be responsible for furnishing all materials necessary for testing.

1.07 CODE COMPLIANCE TESTING

Inspections and tests required by codes or ordinances or by a plan approval authority, and made by a legally constituted authority, shall be the responsibility of and shall be paid for by the **Contractor**, unless otherwise provided in the Contract Documents.

1.08 CONTRACTOR'S CONVENIENCE TESTING

Inspection or testing performed exclusively for the **Contractor's** convenience shall be the sole responsibility of the **Contractor**.

1.09 SCHEDULES FOR TESTING

A. Establishing Schedule

1. The **Contractor** shall, by advance discussion with the testing laboratory, determine the time required for the laboratory to perform its tests and to issue each of its findings, and make all arrangements for the testing laboratory to be onsite to provide the required testing.

2. Provide all required time within the construction schedule.

B. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the testing laboratory as required.

1.10 TEST AND CERTIFICATIONS

A. General: As a minimum, the following tests shall be performed and the following certifications provided:

1. Cement: Certified test results by cement manufacturer or by independent laboratory shall be furnished as required by the **County**.
2. Aggregate and Mortar Sand: Certified test results by aggregate producer or by independent laboratory shall be furnished as required by the **County**.
3. Concrete
   a. At least five standard 6-inch cylinders shall be taken each day for each

100 cubic yards or fraction thereof for each class of concrete used.

b. The number of cylinders, the point of sampling, and the method of securing the samples shall be determined by the **County**.
c. All samples shall be taken to the testing laboratory for laboratory curing.
d. Two of the laboratory cured samples shall be tested at 7 days, two samples tested at 28 days; one sample held in reserve.
e. Test all concrete in accordance with ASTM C31-69, C39-71, and C-172.
f. Slump Tests
    1) Perform slump tests on the job in accordance with ASTM standards.
    2) One slump test shall be performed for each 25 cubic yards of concrete.
    3) More slump tests shall be performed if deemed necessary by the **County**.
g. Perform air entrainment tests in accordance with the following standards:
    1) Field tests - ASTM C 173
    2) Laboratory tests - ASTM C 231

B. Precast and Concrete Block for Buildings

1. Block and precast may be visually inspected on the site by the **County**.
2. The **County** reserves the right to have the concrete block tested by an independent laboratory.

C. Steel and Miscellaneous Metal: Reinforcing steel, structural steel, and miscellaneous metal may be inspected visually on the site by the County.

D. Welding: 1 percent minimum of all structural welds during construction shall be inspected either visually or by an independent laboratory as required by the County.

E. Compaction of Earthwork

1. The compaction shall be tested by an independent laboratory.
2. The testing shall be performed in a manner in accordance with these Specifications.

F. Bituminous Concrete: The material testing for the bituminous concrete shall be performed by an independent laboratory as deemed necessary by the County.

1.11 TAKING SPECIMENS

Unless otherwise provided in the Contract Documents, all specimens and samples for tests shall be taken by the testing laboratory or the **County**.

1.12 TRANSPORTING SAMPLES

The **Contractor** shall be responsible for transporting all samples, except those taken by testing laboratory personnel, to the testing laboratory.

END OF SECTION

SECTION 01510

SANITARY SEWER MAIN TELEVISION AND INSPECTION (CCTV)

PART 1 — GENERAL

1.01 SECTION INCLUDES

This section includes guidelines and requirements for CCTV Inspection. CCTV inspection identifies structural defects, maintenance concerns, and actual and potential sources of I/I in mainline sewers, service laterals, and manholes. CCTV inspection will also be used to verify installed assessment, cleaning, rehabilitation and/or replacement work as required.

1.02 REFERENCES

A. Codes, Specifications, and Standards - NASSCO – National Association of Sewer Service Companies – Pipeline Assessment Certification Program (PACP) Reference Manual, Version 7.0 or latest version.

B. Manual for Uniform Traffic Control Devices (MUTCD) standards

C. Attachment A – PACP Standard Exchange Database Anticipated Inspection Header Form Attribute Guidance Table (CCTV) (Reference NASSCO PACP Reference Manual, Version 7.0 for related information.

1.03 RELATED SECTIONS

A. Section 02956 – Sanitary Sewer Cleaning

1.04 DEFINITIONS

A. Television Inspection: Operation necessary to complete a true-color audio-visual inspection verifying existing internal pipe conditions including pipe materials, pipe grade, connections, cracks, leaking joints, seepage and roots. **Contractor** shall furnish all labor, materials, equipment, tools, and other incidental services for CCTV.

B. MPEG: MPEG (pronounced M-peg), which stands for Moving Pictures Experts Group, is the nickname given to a family of International Standards used for coding audio- visual information in a digital compressed format. For the purposes of this specification, MPEG shall be defined as an ISO-MPEG Level 4 standard (MPEG-4) digital audio-visual coding having a minimum resolution of 500 lines. All video files shall be named using .mpg or .wmv as the file extension.

C. External Hard Drive: For the purposes of this specification, an external hard drive is a peripheral auxiliary device connected to the computer via a high-speed interface cable. The interface cable allows the external hard drive to communicate with the computer so the data may be passed back and forth. The **Contractor** will deliver all inspection standard exchange databases, digital reports and media to the **County** on an external hard drive compatible with the **County's** equipment and

software and will provide adequate storage to contain all deliverables as outlined in the Specifications.

D. Buried Manhole: A manhole where the manhole cover (lid) is not visible at ground surface. Buried manholes usually require removing the material (excluding light dirt and plant material) covering the manhole lid and raising the manhole frame and cover (lid). All buried manholes on the sanitary systems shall be reported for rising following their location discovery by the **Contractor**.

1.05 SUBMITTALS

A. Submittals are to be in color PDF format for printed documents as well as other required formats when applicable for digital transfers.

B. Submit one example video on external hard drive of previous sewer inspection work that shows operational and structural defects in sewers, complete with audio commentary and inspection log(s).

1. Videos and inspection logs will be reviewed by the **County** to determine if quality of CCTV image is acceptable, if defects were properly identified, picture clarity, advancement speeds and lighting are acceptable and documented according to industry standards and the **County's** requirements.

2. Modify equipment and/or inspection procedures to achieve report material of acceptable quality.

3. Do not commence Work prior to approval of report material quality by the **County**. Upon acceptance, report material shall serve as standard for remaining Work.

C. Records reports shall include a separate report for each pipe segment showing inspection setup data, each defect and locations of laterals, and other coded information. Also, each report shall include photographs of moderate and severe defects. Each report shall also note the labeling number of the corresponding video recording of that pipe segment. The video record of the pipe inspections shall be provided digitally on an approved mass storage device. These records shall include all video information and narrations. The video files shall have a unique name referenced in the PACP inspection database. The file name shall include manhole ID numbers for upstream and then downstream manholes as the start of the file name. It is preferred the direction of the inspection and inspection date be included as well.

D. Camera specification sheet

E. References: Contact names and telephone numbers

F. List of staff and equipment to be used on this Project

G. Supervisor and field crew leader's contact information including name and mobile telephone numbers

H. Confined space entry certification indicating staff to be used on this project have been properly trained should confined space entry be required

I. Training and inspection plan a minimum of 7 days prior to the first inspection

J. Public notification door hanger based on the **County's** provided example

K. Inspection (See Documentation Section for additional information)

1. Initial first day's inspections within 24 hours after first day's work is completed.

L. Include the following with each weekly submittal:

1. Inspection media (videos and photographs)

2. Quality controlled Inspection database (PACP Standard Exchange Access Database)

3. Inspection reports (PDF – Digital format)

M. Traffic control plan

N. Quality control plan

1.06 EXPERIENCE

A. Supervisor of the field crews performing these functions shall have the proper training and up- to-date NASSCO PACP certification in these types of equipment and monitoring functions and have a minimum of five (5) years' experience in performing such assignments including safe work practices, etc.

B. Field crew leaders performing these functions shall have the proper training and up to date NASSCO PACP certification in these types of equipment and monitoring functions and have a minimum of two (2) years' experience in performing such assignments including safe working practices, etc.

C. The **Contractor** shall provide the **County** with written documentation (certification) indicating the supervisor, field crew leader and all crewmembers responsible for these assignments have the proper training and the requisite experience.

D. No crew members shall enter confined spaces without the necessary certified training and permit.

E. The required experience shall be documented in the **Contractor's** Invitation to Bid submittal.

F. A PACP certified technician or supervisor shall control operation of television equipment and encoding of inspection. Should **Contractor** utilize any personnel to actually document the inspection results not PACP certified, those inspections shall be refused and re-survey shall be completely at the **Contractor's** sole expense.

1.07 RESPONSIBILITY FOR OVERFLOWS/SPILLS AND DAMAGE TO PROPERTY AND UTILITY

A. All backups, overflows, spills and all associated damage is the **Contractor's** responsibility.

PART 2 - PRODUCTS

2.01 CCTV PERFORMANCE

A. The **Contractor** shall furnish the following, but not limited to: the mobile television inspection studio, television camera, sonar, audio-visual digital encoding equipment/software, and other necessary equipment, materials, power, labor, and technicians as needed to perform the television inspection.

B. The surveying/inspecting equipment will be capable of surveying/inspecting a length of sewer up to at least one-thousand five-hundred (1,500) feet when entry onto the sewer may be obtained at each end and up to one-hundred (100) feet by rodding or up to seven-hundred and fifty (750) feet where a self-propelled unit is used, where entry is possible at one (1) end only. This equipment will be maintained in full working order.

C. Each survey/inspection unit will contain a means of transporting the CCTV camera and/or sonar equipment in a stable condition through the sewer under survey and/or inspection. Such equipment will ensure the maintained location of the CCTV camera or sonar equipment when used independently on or near to the central axis of a circular shaped sewer when required in the prime position.

D. Where the CCTV camera and/or sonar head are towed by winch and bond through the sewer, all winches will be stable with either lockable or ratcheted drums. All bonds will be steel or of an equally non-elastic material to ensure the smooth and steady progress of the CCTV camera and/or sonar equipment. All winches will be inherently stable under loaded conditions. The bonds shall be oriented in such a manner as to enable unhindered extension or retraction through the line. All effort shall be made to prevent damage to the pipe during the television inspection. In the case where damage is caused by the **Contractor**, for any reason, such as would be caused by incorrect deployment of bonds or retrieval of lodged equipment, the cost of repair or remedy shall be borne solely by the **Contractor** and repaired immediately after notification to the **County** within 24 hours. Contractor shall take all necessary precautions to prevent an SSO including bypass pumping.

E. Each unit will carry sufficient numbers of guides and rollers such that, when surveying or inspecting, all bonds are supported away from pipe and manhole structures and all CCTV cables and/or lines used to measure the CCTV camera's head location within the sewer are maintained in a taut manner and set at right angles where possible, to run through or over the measuring equipment.

F. Each unit will carry a range of flow control plugs or diaphragms for use in controlling the flow during the survey/inspection. A minimum of one (1) item of each size of plug or diaphragm ranging from the required diameters will be carried.

G. Each survey/inspection unit will have on-call equipment available to carry out the flushing, rodding, and jetting of sewers for “Light Cleaning” See the definition of “Light Cleaning” in Sanitary Sewer Cleaning Specification 02956 for details.

H. Television Inspection: The **Contractor** shall inspect pipelines with pan and tilt conventional television imagery and/or sonar as indicated in the contract documents so as to record all relevant features and defects of the pipeline under inspection. Inspection of pipelines shall be carried out utilizing the **County** approved formats only.

I. External Hard Drive (Videos):

1. Audio portion of videos shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of oral report.

2. Store in upright position with temperature range of 45 to 80 degrees F (7 to 27 degrees C).

3. Identify each hard drive with labels showing **County’s** name, **Contractor’s** name, the inspection period, and project area or sewer segments on the hard drive.

J. Hard Drive Titling:

Each segment shown on the external hard drive should have its own video titled with the beginning and end point of the pipe segment.

K. CCTV Camera Head Prime Position:

The CCTV camera head will be positioned to reduce the risk of picture distortion. In circular sewers the CCTV camera lens and/or sonar head will be positioned centrally (i.e. in prime position) within the sewer. In non-circular sewers, picture orientation will be taken at mid-height, unless otherwise agreed, and centered horizontally. In all instances the camera lens head will be positioned looking along the axis of the sewer when in prime position. A positioning tolerance of ± 10% of the vertical sewer dimension will be allowed when the camera is in prime position.

L. CCTV Camera Head Speed:

The speed of the CCTV camera in the sewer will be limited to six (6) inches per second or 30 ft/min for surveys. Similar or slightly higher speed may be used on a case-by-case basis. Stop for a minimum of five (5) seconds at every lateral, defect, or adversity. The speed of scanning sonar will be limited to four (4) inches per second.

M. CCTV Color Camera:

The television camera used for the pipe line inspection shall be one specifically designed for hazardous and corrosive environments and constructed for pipeline inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall adhere to the following requirements:

1. Waterproof and shall be operative in 100% humidity conditions with lens fogging and any conditions that may be encountered in the inspection environment.

2. Self-leveling, color pan and tilt camera(s) to facilitate the survey and inspection of all laterals, including defects such as hydrogen sulfide corrosion in the soffit of sewers and benching or walls of manholes over and above the standard defects that require reporting.

3. A three-hundred sixty (360) degrees rotational scan indicating general condition must be implemented at every fifty (50) feet interval (min.) along sewers, and at manholes and any salient, specified, defect features.

4. The tilt arc must not be less than two-hundred seventy (270) degrees with adjustable supports designed for operation in connection with pipe inspection with a viewing angle of not less than 65 degrees.

5. The view seen by the television camera shall be transmitted to a monitor of not less than 11 inches in size.

6. The travel speed of the television inspection camera (through the pipe) shall be uniform and shall not exceed the maximum speed herein specified.

7. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the **County**; and if unsatisfactory, equipment shall be removed and no payment will be made for an unsatisfactory inspection.

8. The adjustment of focus and iris will allow optimum picture quality to be achieved and will be remotely operated.

9. The adjustment of focus and iris will provide a minimum focal range from six (6) inches in front of the camera's lens to infinity.

10. The distance along the sewer in focus from the initial point of observation will be a minimum of twice the vertical height of the sewer.

11. The illumination must be mounted on and turned in the direction of the camera such as to allow an even distribution of the light around the sewer perimeter without the loss of contrast picture, flare out, or shadowing, light sensitivity to be greater than 1.5 lux minimum, minimize reflective glare, remote variable intensity control, provide a clear in-focus picture of entire inside periphery of pipe and the ability to achieve proper balance of tint and brightness.

N. Color CCTV :

All CCTV and/or sonar work will use color CCTV reproduction. CCTV Side Scanning Camera:

The **County** will consider high resolution digital CCTV side scanning cameras if proposed by the **Contractor**. The **County** may not accept the side scanning camera use for this project if the **contractor** cannot provide supporting documents showing previous successful application.

O. The survey/inspection vehicle for general public streets or assessable locations will comprise two (2) distinct separate areas. One (1) of these, designated as the viewing area, will be insulated against noise and extremes in temperature, include the provision for air conditioning, and will be provided with means of controlling external and internal sources of light in a manner capable of ensuring that the monitor screen display is in accordance with the requirements of this specification. Seating/and or space accommodations will be available to enable additional workers to clearly view the on-site monitor, which will display the survey/inspection as it proceeds.

P. The working area will be reserved for equipment, both operational and stored, and no equipment utilized within the sewer will be allowed to be stored in the viewing area.

Q. The vehicle will be suitable for carrying the survey team and laborers and the equipment necessary to safely perform the work.

R. Off road inspection equipment/easement machine proposed by the **Contractor** shall be reviewed and approved by the **County** before the **Contractor** utilizes said equipment.

PART 3 - GENERAL

3.01 EXECUTION

A. The following guidelines concerning the use of CCTV will be followed:

1. Generally, CCTV alone will be used for internal condition assessment where the depth of flow is less than twenty-five (25%) percent of overall sewer volume at the start of the survey. If the flow volume is greater than 25%, as agreed upon by the **County**, bypass pumping may be required.

B. Confined Space Entry: Crews shall minimize the physical entry into manholes. Manhole entry shall be performed in accordance with Federal, State, Local and any other regulations for confined space entry. Only trained crews and staff may perform confined space entry after obtaining an entry permit. Staff must use safety required equipment, including harnesses, ventilation equipment, etc.

C. The **Contractor** shall make map verifications and record and deliver GIS map corrections as necessary meeting the DeKalb County Department of Watershed Management Potable Water Main, Gravity Sanitary Sewer, and Sanitary Sewer and Force Main Design Standards, Latest Edition and Version.

D. Traffic Control: The work area shall be protected at all times with an adequate number of cones, barricades, flags, certified flaggers, and other measures necessary to meet the Manual for Uniform Traffic Control Devices (MUTCD) standards and to properly and safely protect both vehicular and pedestrian traffic. Flagmen shall work to secure all affected streets. Further requirement for traffic control may be imposed by the specific agency having jurisdiction. All traffic control measures shall comply with the requirements of MUTCD, Part 6 – Temporary Traffic Control, Latest Edition as published by USDOT/FHWA.

E. Site Security: Wear all required safety equipment, such as safety vests, hardhats, safety glasses, and steel toe boots. Follow all applicable state and local traffic safety procedures. Alert the closest fire department/Emergency Medical Services (EMS) as to the location of the day's work and to stand by for emergencies.

F. Scheduling Time: Crews shall begin inspections after 8:00 am and terminate inspections no later than 5:00 pm each day unless otherwise directed by the **County** in order to address localized special requirements. Authorization should be

obtained if work is to be performed outside of the designated hours. Work should be performed by the **Contractor** in time frames complying with the **County's** noise ordinance.

G. Permits for Rights of Ways & Contract Utility Licensing: The **Contractor** shall obtain work permits for all work to be performed in State and/or County Right of Ways. The **Contractor** shall also plan for all other insurances, traffic control measures, and other terms of the permit in advance. The **Contractor** shall also obtain all necessary and applicable licensing.

H. Sequence of Work:

1. Perform Work in the following sequence:

   a. Clean sewer lines and manholes in accordance with "Light Cleaning" requirements of **Section 02956 - Sanitary Sewer Cleaning**.

   b. **Contractor** shall remove debris in accordance with guidance in **Section 02956 - Sanitary Sewer Cleaning**.

   c. After cleaning, the manhole sections shall be visually inspected by means of CCTV. The inspection then will be done one linear section at a time and the flow in the section being inspected will meet the minimum PACP requirements. All CCTV inspections shall be performed in accordance with PACP standards including the specific date and time of inspection.

I. Inspection equipment shall utilize software capable of providing complete survey reports, inspection standard exchange database, and linked media files; equipped with modules necessary for NASSCO Pipeline Assessment and Certification Program inspection.

J. If television inspection of an entire manhole to manhole sewer segment cannot be successfully performed from one manhole, a reverse setup shall be performed to obtain a complete inspection. A reverse setup shall be considered incidental to and included in the segment's unit price bid for CCTV inspection. If upstream (reverse) setup, is required, establish new inspection run separate from downstream (normal) setup so two inspection records exist in the software, one with the normal setup and one with the reverse setup.

K. Televised pipe segment inspection is represented by one manhole-to-manhole pipe segment or other structural access-to-access point; not multiple manhole-to-manhole segments.

L. Show continuous footage reading and other required information on inspections image. Place on screen where it is clearly visible (if black font, do not place on dark background, if white font, do not place on light background).

M. Viewing shall be in direction of flow, except while camera is being used in a reverse setup. Inspection shall proceed from upstream to downstream, unless prohibited by obstruction.

N. Keep camera lens clean and clear. If material or debris obscures image or causes reduced visibility, clean or replace lens prior to proceeding with recording operation.

O. Camera lens shall remain above visible water level and may submerge only while passing through clearly identifiable line sags or vertical misalignments. If flow exceeds 25 percent of diameter and the camera lens becomes obscured, pause inspection until flow subsides. If necessary, reschedule CCTV operation. Surcharging and flooding of camera lens is not an excusable condition if it has been artificially created upstream, i.e., placement of flow plugs or freshwater flushing in pipe.

P. Pan the camera to record the inside of each lateral or connecting pipe and the connection of lateral or connecting pipe to sewer pipeline.

Q. Recordings shall clearly show all defects and observations, and their severity in addition to obvious features, i.e., laterals and joints.

R. Immediately report to the **County** any obstructions restricting flow and causing inspection to be interrupted. Assure the obstruction is documented in the inspection with the appropriate defect code. Document condition with still photographs, and begin a reverse inspection setup or inspections of other pipelines to the satisfaction of the **County**.

S. Televise pipe segments from manhole to manhole on same video in continuous run.

1. Video shall clearly show camera starting and ending at manhole, unless defects do not allow it.

2. Do not perform partial televising on one video and then complete run on another video.

3. If line is partially televised, due to excusable condition, i.e., collapsed line, televised length shall be viewed by the **County**.

4. If a portion of the **Contractor's** inspection is unacceptable to the **County**, the entire pipe segment shall be deemed unacceptable and the **Contractor** shall re-televise the entire pipe segment at the **Contractor's** sole expense.

T. The **County** may, on occasion, accept a physical inspection not adhering to minimum standards if adverse conditions are encountered and re-inspection is not advised.

3.02 CCTV INSPECTION

A. Data Transfer: Upon completion of CCTV inspection, transfer inspection data to an external hard drive (HD) of sufficient capacity and compatibility with the **County's** equipment and available programs; include code required for proper playback of video file.

B. Labeling: Provide printed label on outside of HD that indicates the following:

1. Name of **County**

2. Project title

3. Date of submittal

4. Inspection company

5. Deliverable number

6. Project assignment area (provided by the **County**)

C. Media:

1. Video:

a. Inspections completed, with a unique filename per manhole to manhole pipe segment inspection.

b. Continuous digital video recordings of the inspection view as it appears on the television monitor shall be taken. The recording shall also be used as a permanent record of defects.

c. The recording shall be MPEG-4. Separate MPEG-4 files shall be created for each pipe. In case of a reverse setup, such inspection shall be stored in a separate inspection record and MPEG file. MPEG files shall be written to External Hard Drive media for delivery to the **County**.

d. MPEG files shall be named according to the following file specification:

TV_[PIPEID]_[Direction]_[MMDDYYYY]_[Incremental Number].mpg

e. The incremental number shall be used if multiple inspections are performed for the same line, such as a reverse inspection setup.

f. The **County**, at its sole discretion, reserves the right to refuse any MPEG, on the basis of poor image quality, excessive bit rates, inconsistent frame rates or any other characteristics that may affect usability by the **County**.

g. The digital video encoding shall include video information that can be reproduced with a video image equal or very close to the quality of the original picture on the television monitor. The replay of the recorded video information shall be free of electrical interference and shall produce a clear, stable image.

2. Audio:

a. Embedded in video file

b. Operator will include description of inspection setup, including related information from log form and unusual conditions

c. Operation changes (for example, remove roots and restart inspection at footage prior to root removal)

d. Verbal description and location of each defect

e. Verbal description and location of each service connection

D. Still Photographs:

1. Provide color digital photographs showing inspection image whenever observation or defect has a moderate or major severity; looking into a lateral or connection pipe; or unless otherwise instructed by the **County**;

2. Each with a unique filename matching the asset ID with a random number;

3. Encoded in .JPEG format;

4. Minimum 1024 x 768 resolution; and

5. Provide label on front of photograph with structure identification number, footage (if not visible on photograph), and defect code (if applicable).

E. Database:

1. Include all inspections in a single consolidated PACP Version 6 or newer Access Standard Exchange database. Creating a database per inspection is not acceptable. Each submittal standard exchange database shall be cumulative containing all prior inspections as well as inspections conducted during interim period since previous submittal.

2. Prior to the start of the Work, provide PACP standard exchange database of collected data including anticipated inspection header field attribute information. A PACP Inspection Header Guidance Table will be provided upon request.

3. File Type: MS Access, .MDB, .ACCDB

4. Database Format: PACP Version 6 or newer. NASSCO PACP data will be exported into Standard PACP Standard Exchange database.

5. List inspection media names in corresponding asset/inspection/defect information field within database.

F. Linear Measurement:

1. The CCTV monitor display will incorporate an automatically updated record in feet and tenths of a foot of the footage of the camera or center point of the transducer, whichever unit is being metered, from the cable calibration point, the pipe diameter (physical measurement by **Contractor**), and verified pipe material. The relative positions of the two (2) center points will also be noted.

2. The **Contractor** shall use a suitable metering devise enabling the cable length to be accurately measured; this shall be accurate to 0.20 feet. The **Contractor** shall use the footage readings to identify location of defects to the nearest 0.10 feet. Measurement shall be zeroed after each segment inspected. The **Contractor** shall calibrate the footage meter on a regular basis and demonstrate that the tolerance is being achieved by tape measurement between manholes on the surface. This taped measurement must be included on a quality control form which will be completed and submitted by the **Contractor** depicting the level of accuracy achieved.

G. Data Display, Recording and Start of Survey/Inspection:

1. At the start of each sewer length being surveyed or inspected and each

reverse set-up, the length of pipeline from zero (0) footage, the entrance to the pipe, up to the cable calibration point will be recorded and reported in order to obtain a full record of the sewer length. Only one (1) survey will be indicated in the final report. All reverse set-ups, blind manholes, and buried manholes will be logged on a separate log. Video digits will be recorded so every recorded feature has a correct tape elapsed time stamp. Each log will make reference to a start and finish manhole unless abandonment took place because of blockage.

2. The footage reading entered on to the data display at the cable calibration point must allow for the distance from the start of the survey/inspection to the cable calibration point such that the footage at the start of the survey is zero (0).

3. In the case of surveying through a manhole where a new header sheet and file must be created, the footage will be set at zero (0) with the camera focused on the outgoing pipe entrance.

4. At the start of each manhole length a data generator will electronically generate and clearly display on the viewing monitor and subsequently on the video recording a record of data in alpha-numeric form containing the following minimum information:

   a. Automatic update of the camera's footage position in the sewer line from adjusted zero (0)

   b. Sewer dimensions

   c. Manhole/pipe asset ID number

   d. Date of survey

   e. Road name/location

   f. Direction of survey

   g. Time of start of survey

   h. Sewer use (SS - Sanitary Sewer)

   i. Material of construction of the pipe

   j. The size and position of the data display will be such as not to interfere with the main subject of the picture.

5. Once the survey of the pipeline is under way, the following minimum information will be continually displayed:

   a. Automatic update of the camera's footage position in the sewer line from adjusted zero (0).

   b. Manhole or pipe asset ID number.

   c. Defect/observation code(s) (temporarily display when encountered)

   d. Date and time

6. Before camera enters the pipe, inspection shall provide video of the manhole. Video recording shall begin by facing pipe segment to be televised and then pan/tilt/zoom as necessary to point camera up toward the manhole opening.

H. Coding: Defect Coding, as well as material, shape, and lining coding, and conventions used will comply with PACP formats and will be compatible with the **County's** GIS.

3.03 MAN ENTRY SURVEY

A. Photographic Camera Position - General Illustration of Sewer Interior:

1. The hand-held photographic camera or CCTV camera will be positioned to reduce the risk of picture distortion. In circular sewers the camera lens will be positioned centrally looking along the axis of the sewer. In non-circular sewers picture orientation will be taken at mid-height, unless otherwise agreed, and centered horizontally.

2. The hand held photographic camera or CCTV camera will be positioned so the long side of the photograph or CD-ROM frame is horizontal.

B. Photographic Camera Position - Laterals/Specific Defect: A means of accurately locating the photographic or camera's footage and any recorded lateral or defect, along the sewer will be provided, to an accuracy of ± 1% or six (6) inches, whichever is greater.

C. Photographic Quality: The in-sewer photographic camera or hand held CCTV system and suitable illumination will be capable of providing an accurate, uniform and clear record of the sewer's internal condition.

3.04 DELIVERABLES

A. Digital PACP Standard Exchange database shall be submitted on external hard drive in duplicate to the **County**. The database must contain all the data required by this specification.

B. Final Television Inspection Reports shall be submitted to the **County** in PDF on the same external hard drive referenced above. Corresponding MPEG videos and photos shall also be submitted to the **County** as outlined by this specification.

3.05 PUBLIC NOTIFICATION – CCTV INSPECTION

A. Public notification is critical and compliance with the public notification criteria is a prerequisite for CCTV inspection, especially when conducting inspections on sewers in easements passing through private property. Notification must be provided to all property occupiers/owners likely to be affected including residential, commercial and institutional (schools, hospitals, nursing homes, etc.). At a minimum, the following steps shall be taken:

1. The **Contractor** shall print and distribute pre-approved advance notice

door hangers 72 hours before conducting CCTV inspection. The **Contractor** shall distribute the door hangers to the property owners (residential, commercial and institutional) in the affected area(s).

2. The advance notice door hangers shall be customized by Public Outreach to suit this project and will be provided to the **Contractor** for printing prior to project commencement. If CCTV inspection is delayed, the **Contractor** must re-distribute door hangers.

3. The **Contractor** is responsible for distributing pre-approved "Right-of-Entry" (ROE) forms and securing signatures from affected property owners on the ROE forms prior to conducting CCTV inspection.

B. The **Contractor** shall keep a daily log of the distribution of the door hangers. This shall be maintained and submitted to the **County** upon request.

C. The **Contractor** shall alert the appropriate **County** personnel of their work locations on a daily basis.

D. **Contractor** will provide and place "Right-of-Way" signs in prominent locations where CCTV is planned 24-hours in advance of commencing the inspection. Signs will be a minimum of 24 inches wide by 18 inches high with letters a minimum of 2 inches high. Signs will be supported a minimum of 12 inches above grade by integral metal frames. Wording on the signs shall be similar to the following:

CCTV INSPECTION WILL BE CONDUCTED ON "date" and "time." Contact "person" with "company" at "phone number" for additional information.

3.06 QUALITY ASSURANCE/QUALITY CONTROL

A. Data Quality Control Procedure:

1. The **Contractor** shall perform a Quality Control (QC) check of the televised inspection documentation using the QC database provided by the **County**.

2. The **Contractor** shall correct any data conflict, missing data, or other questionable entry identified by the conflict, missing data, or other questionable entry identified by the QC reports prior to submitting the CCTV inspection data to the **County**.

B. The **Contractor** shall establish and perform a QA/QC analysis addressing all video and data recorded before the data is submitted to the **County**. The **County** will periodically request the **Contractor** to review the QC results with the **County**.

C. The data submissions shall undergo the same random review checks for Quality when submitted to the **County**. Should accuracy or qualitative levels fall below those deemed acceptable to the **County**, the data submittal will be refused and no payment will be released. **Contractor** will be required to correct or re-do inspections until the **County** is satisfied with the work.

3.07 DOCUMENTATION

A. The **Contractor** shall complete work on each asset as described herein. Refer to **Section 01210 - Measurement and Payment** for documentation required with each pay request.

B. Measurement Units: All dimensions will be in feet and inches. Sewer measurement will be to the nearest inch.

C. CCTV and Man-Entry Photographs: Photographs will be taken of all laterals or connecting pipes and moderate or severe pipeline defects. Where a defect is continuous or repeated the photographs will be taken at the beginning of the defect and at not less than ten (10) foot intervals thereafter.

D. The **Contractor** shall complete weekly and end of work television/inspection reports as described herein. These reports shall be per the format and defect codes of NASSCO's Pipeline Assessment and Certification Program (PACP). Prior to beginning work, the **Contractor** shall submit a digital sample of the television inspection report to the **County** for approval.

END OF SECTION

SECTION 01540

SECURITY AND SAFETY

PART 1 - GENERAL

1.01 SECURITY PROGRAM

A. The **Contractor** shall protect the Work, including field office trailers and contents, from theft, vandalism, and unauthorized entry.

B. The **Contractor** shall initiate a site security program at the time of mobilization onto the Work site that provides adequate security for material stored and installed onsite.

C. The **Contractor** shall maintain the security program throughout the Contract duration.

D. The **Contractor** and subcontractors shall be wholly responsible for the security of its storage compound and laydown areas, and for plant, material, equipment, and tools at times.

E. The **Contractor** shall provide the **County** with a list of 24-hour emergency phone numbers, including chain of command.

F. The **Contractor** must cooperate with Owner on all security matters and must promptly comply with any project security arrangements established by the Owner or Program Manager.

G. It is the **Contractor's** obligations to comply with all applicable governmental requirements and regulations and to undertake reasonable actions to establish and maintain secure conditions at any job site.

H. The **Contractor** shall be solely responsible for the safety and security of materials, equipment, their employees, their subcontractors and or any person who enters County's premises for any reason(s) related to this contract.

I. The **Contractor** shall comply with the site safety and security program at all times on the Owner's facilities.

J. The **Contractor** shall only allow entry to authorized persons with proper Owner-approved identification. All Contractor and Subcontractor employees will be required to have personnel working at these facilities photographed for an Owner-provided identification (ID) badge before they start work.

K. The **Contractor** shall not allow cameras on-site or photographs to be taken, except those required to perform the Work in accordance with the Contract Documents or otherwise approved by Owner. Photos taken on the County property for any reason (mishaps, near misses, accidents etc.) are prohibited from being used for Social Media and Training references unless authorized by the County.

L. It is the responsibility of the **Contractor** to ensure all articles of possible personal or monetary value found by the Contractor's employees are turned into the Owner or Program Manager.

M. The **Contractor** shall be responsible for maintaining satisfactory standards of employees' competency, conduct, courtesy, appearance, honesty and integrity, and shall be responsible for taking such disciplinary action with respect to any employee, as may be necessary.

N. The **Contractor** shall provide the County with a list of 24-hour emergency phone numbers, including a chain of command.

O. **Contractors** with non-English speaking employees shall provide an English speaking person, who has the ability to translate or communicate vital project specific or safety information.

1.02 PROJECT SAFETY

A. DRUG AND ALCOHOL POLICY

Any person under the influence of /or in possession of, distributing and/or selling control substances and/or alcohol will be removed from the site immediately. Prescription medication is allowable if it is contained in its original package and does not affect an employee's performance. DWM has a zero tolerance Drug and Alcohol policy.

B. COMPETENT PERSON REQUIREMENTS

Contractor and their Subcontractor shall have a Competent Person on the project for all operations as required by OSHA Standards.

1. A competent person identified and on-site before any scaffold erection may begin and/or modified.

2. A competent person identified and on-site before any excavation may begin and/or modified.

3. A competent person identified and on-site before any Confined Space may begin.

4. A competent person identified and on-site before any rigging operation may begin.

5. A competent person identified to erect and inspect concrete formwork.

OSHA defines a competent person as one who is capable of identifying existing and predictable hazards in surroundings or working conditions that are unsanitary, hazardous or dangerous to employees, and who has the authority to take prompt corrective measures to eliminate them.

C. COMMUNICATIONS

1. Contractor shall Plan and execute all work in a manner, which complies with the stated objectives of their Project Safety Program.

2. Contractor employees and their subcontractors shall complete a Project Site-Specific Health and Safety Orientation identifying projects hazards, detailing these specified project rules and DeKalb County Watershed Management Project Rules **(See Section C).** Employees shall complete this orientation before starting work.

3. Contractor shall create and maintain for project(s) an emergency action plan (EAP) which addresses the notification of the closet police, fire or ambulance and rescue services.

4. In case of a utility line break please contact 911 in addition to DWM Dispatch at 770-270-6243, the utility owner (Sewer, Water, Gas, Cable, and Electrical) and your project contract public relation representative. Please note: Gas Sewer and Electrical lines are considered Hazardous. Prompt emergency actions must follow immediately.

5. Contractors are required to have on file in the job trailer, a copy of their company's Safety Program and Hazard Communication Program.

6. All accidents must be reported to DWM Management immediately after occurrence. Accident reports and investigation forms must be completed and a copy to DWM Safety within 24 hours of an accident. All incidents or near misses must be reported to DWM Safety immediately for proper investigation and corrective actions to ensure prevention.

7. Contractor's accident/incident report shall contain (but not be limited too) the following:

    a. Name of person injured
    b. Date and time of injury
    c. Name(s) of all witnesses
    d. Details of the accident
    e. Root Cause analysis of accident
    f. Action taken to prevent re-occurrence of incident/accident
    g. Nature/Extent of injury
    h. Name of doctor/ emergency provider

8. All contractor personnel requiring medical attention shall be drug screened in accordance with the County's policy.

9. Tool Box Talks must be completed at least weekly. The toolbox talk must be documented with the signatures of all employees attending. Topics should include information relative to ongoing or upcoming operations and previous week's accidents.

10. Subcontractors must maintain and have available first aid and bloodborne pathogens kit.

11. Contractors and their subcontractors are responsible for transportation and payment for treatment of their employees. It is the responsibility of each contractor to arrange for medical treatment of his or her injured employees.

12. Contractors and Subcontractors are responsible for the conduct of their employees and housekeeping of the construction/project site.

13. Any damage to existing or stored property or materials will financially be the sole responsibility of the offending subcontractor(s).

D. DISCIPLINARY POLICY

1. Contractor employees must work safely as a condition of employment on this project. DeKalb County reserves the right to remove any contractor employees from this project for unsafe behavior or failure to follow safe work practices. Insubordination or any act that causes an Immediately Dangerous to Life and Health (IDLH) situations will not be tolerated and will result in automatic removal.

E. PROJECT SITE

1. Vehicle parking is in designated areas only - Forward First Policy.

2. Report all unsafe site conditions to DWM Management for which the contractor does not have the resources or is not responsible to implement corrective action.

3. Only trained, certified and authorized employees shall operate forklifts, aerial lifts, cranes, machinery, heavy equipment, tools, and vehicles. All equipment shall be operated in accordance with manufacturer's specifications and all other applicable laws/standards. The operator must have certification cards on their person.

4. Cell phones are not allowed to be used onsite except for supervisors and management.

5. All subcontractors shall have warning devices on moving equipment and trucks in the proper working order while on site.

F. ELECTRICAL

Subcontractors must use either an assured grounding program and/or Ground Fault Circuit Interrupters (GFCI) for protection from shock/electrocution.

G. HAZARDOUS COMMUNICATION PROGRAM

Contractors are required to have on file with DWM and project job trailer, a copy of their company's Hazard Communication Program. Hazard Communication programs must include an inventory list of hazardous materials, explanation of their labeling system, and all corresponding safety data sheets (SDS) and name of the program coordinator. Contractor shall make the inventory list of hazardous materials available upon request by the County.

1.03 ENTRY CONTROL

A. The **Contractor** shall restrict entry of unauthorized personnel and vehicles onto the Project site.

B. The **Contractor** shall allow entry only to authorized persons with proper identification.

C. The **Contractor** shall maintain an Employee Log and Visitor Log and make the log available to the **County** upon request. This log shall be submitted to the **County** bi-weekly, or as necessary.

D. The **Contractor** shall require visitors to sign the Visitor Acknowledgment of the Program Site Rules/Visitor Log, which includes a release form. Copies of these forms shall be submitted to the **County** bi-weekly and maintained in the **Contractor's** security files on-site. See **Section** A.

E. The **Contractor** shall require each employee to sign the Employee Acknowledgment of Project Site Rules Log included in **Section C**. Employees, subcontractor employees, and lower-tier **Contractor** employees will receive a new employee orientation. Signing the Employee Log by the employee is certifying that the orientation training has been received.

F. The **County** has the right to refuse access to the site or request that a person or vehicle be removed from the site if found violating any of the Project safety, security, or conduct rules.

1.04 BARRICADES, LIGHTS, AND SIGNALS

A. The **Contractor** shall furnish and erect such barricades, fences, lights, and danger signals and shall provide such other precautionary measures for the protection of persons or property, and of the Work as necessary. Barricades shall be painted in a color that is visible at night. From sunset to sunrise, the **Contractor** shall furnish and maintain at least one light at each barricade and sufficient numbers of barricades shall be erected to keep vehicles from being driven on or into any Work under construction.

B. The **Contractor** shall be held responsible for damage to the Work and any resulting injuries due to failure of barricades, signs, and lights. Whenever evidence is found of such damage, the **Contractor** shall immediately remove the damaged portion and replace it at the **Contractor's** cost and expense. The **Contractor's** responsibility for the maintenance of barricades, signs, and lights shall not cease until the Project has been accepted by the **County**.

1.05 RESTRICTIONS

The **Contractor** shall not allow cameras on site or photographs taken without approval of the **County,** except as required under **Section 01380 – Photographic Documentation.**

1.06 CONTRACTOR SAFETY/HEALTH AND SECURITY PLAN

A. Within 30 days of Notice to Proceed, and prior to the performance of any Work, the **Contractor** shall prepare and submit a Contract-specific Health, Safety, and Security Plan signed by an officer of the **Contractor's** organization. Adequacy is the responsibility of the **Contractor**.

B. The **County** will review the **Contractor's** Health, Safety, and Security Plan for the adequacy of the plan. The plan shall:

1. Identify the person(s) responsible for implementation and enforcement of Health, Safety, and Security rules and regulations for this Project.
2. Address safe Work procedures for the activities within the **Contractor's** scope of Work.
3. Include a new employee orientation program to address job- and site-specific rules, regulations, and hazards.
4. Include the **Contractor's** Drug-Free Work Place Policy describing the substance abuse prevention and testing program.
5. Include provisions to protect the **Contractor's** employees, other persons, and organizations possibly affected by the Work from injury, damage, or loss.
6. Comply with current Fed/OSHA regulations; the Health, Safety, and Security Plan; the facility safety program (when applicable); and locally accepted safety codes, regulations, and practices.
7. Include a site-specific emergency action and evacuation plan.
8. Include Hazard Communication/Right-To-Know Program.
9. Include security procedures for the **Contractor's** Work, tools, and equipment.
10. Include the capability of providing the **County** with documentation to show compliance with the plan, plus accidents, and investigation reports.
11. Address other contract-specific requirements, including the Unique Requirements of these specifications.

C. Prior to the start of Work, **Contractor** shall provide Job Safety Analyses (JSAs) for unique Work activities necessary to prosecute the scope of Work.

D. Review of the **Contractor's** Health, Safety, and Security Plan by the **County** shall not impose any duty or responsibility upon the **County** for the **Contractor's** performance of the Work in a safe manner.

E. The **Contractor** shall be fully responsible for the safety and health of its employees, its subcontractors, and lower tier contractors during performance of its Work.

F. The **Contractor** shall provide the **County** with safety reports, training records, competent person list, and accident reports prepared in compliance with Fed/OSHA and the Project Health, Safety, and Security Plan.

1.07 PROJECT SAFETY COORDINATOR

A. The **Contractor** shall be responsible for the safety of the **Contractor's** and **County**'s employees, the **County's** personnel and other personnel at the Work site. The **Contractor** shall identify a Project Safety Coordinator (PSA) on the job with an appropriate office on the job site to maintain and keep available safety records and up-to-date copies of pertinent safety rules and regulations.

B. The Project Safety Coordinator shall:

1. Comply with applicable health and safety requirements of governing legislation.
2. Schedule and conduct safety meetings and safety training programs as required by law and included in the **Contractor** Health, Safety, and Security Plan for personnel engaged in the Work.
3. Post appropriate notices regarding safety and health regulations at locations that afford maximum exposure to personnel at the job site.
4. Post the name(s), address and hours of the nearest medical doctor(s), names and addresses of nearby clinics and hospitals, and the telephone numbers of the fire and police departments.
5. Post appropriate instructions and warning signs with regard to hazardous areas or conditions.
6. Have proper safety and rescue equipment adequately maintained and readily available for any contingency. This equipment shall include such applicable items as: proper fire extinguishers, first aid kits, safety ropes, and harnesses; stretcher, life preservers, oxygen breathing apparatus, resuscitators, gas detectors, oxygen deficiency indicators, explosion meters; and other equipment mandated by law.
7. Inspect each Work crew at least once daily in accordance with an Inspection Checklist Report Form to make sure that workers are wearing their appropriate personal safety equipment; machines, tools, and equipment are in safe operating condition; Work methods are not dangerous; and the Work site and Work methods are free of hazards.
8. Submit to the **County,** upon request, copies of inspection checklist report forms; safety records, safety inspection reports, and certifications from regulating agencies and insurance companies.
9. Immediately notify the **County** of a serious accident, followed by a detailed written report within 24 hours. "Serious accident" is defined as that requiring an absence of Work of more than two days and/or hospitalization.
10. Immediately notify the **County** in the event of a fatal accident.

11. Immediately notify the **County** of any accident claim against the **Contractor** or any subcontractor, followed by a detailed written report on the claim, and its resolution.

12. Review safety aspects of the **Contractor's** submittals as applicable.

1.08 IDENTIFICATION BADGES AND SECURITY

A. All **Contractor's** employees and subcontractors' staff who will be working on-site shall be issued an ID badge by the **County**.

B. Special Circumstances. The **County** can grant/permit a **Contractor** the right to badge their employees and subcontractors. However, the badge template shall be approved by **DWM** Safety Division. The ID badge shall include worker's name, date of issue, picture, and company affiliation.

C. It is the **Contractor's** responsibility to collect the ID badge from any employee who is been discharged or resign prior to completion of the project as well as at completion of the project. **Contractors** shall return all ID badges to the **DWM** Safety Division within 48 hours. The **Contractor** shall be charged a fee of $25.00 per badge for any badges not returned at completion of the project. For ID badges lost during the term of the project, there will be a reissued fee of $15.00 per ID badge. The **Contractor** shall deduct these charges from its periodic or closeout payment request or the **County** shall deduct them.

D. The **Contractor** shall be responsible for maintaining a safe "drug-free" work environment.

E. The **Contractor** shall develop a Security Plan for use on the job site during construction. The Plan shall encompass at a minimum such topics as the use of pre-employment background checks for specific project staff, drug tests, crime prevention and anti-theft procedures, workplace violence, and methods to secure project documents. The staff working on the site shall be familiar with the requirements of the Security Plan.

F. County Ordinances prohibit the carrying of weapons on County property/jobsites. The County Police Department shall be notified of any person bringing weapons to the jobsite; they shall be removed immediately and prosecuted.

G. Persons on the jobsite shall report any suspicious activity by workers or by others at the jobsite area first to the Project Management, and/or DeKalb County Police and/or Fire Department by calling 911 and immediately to the Engineering and Construction Management Service Division Head.

1.09 REMOVAL

A. The **Contractor** shall remove equipment and devices when no longer required and repair damage caused by installation.

B. Should the **Contractor** dismiss employees who have been given access to the DWM facilities while the contract is in force, the Contractor will advise the DWM Security Office.

C. The Owner may request the **Contractor** to immediately remove from the premises and/or dismiss any employee found unfit to perform duties due to one or more of the following reasons:

- Neglect of duty, absenteeism, security or safety problems and sleeping on the job.
- Disorderly conduct, use of abusive or offensive language, quarreling, intimidation by words, actions or fighting.
- Theft, vandalism, immoral conduct or any other criminal action.
- Selling, consuming, possessing, or being under the influence of intoxicants, alcohol or illegal substances, which produce similar effects while on duty.
- Involved in a vehicle accident while on the Owner's property or driving the Owner's equipment. No employee, Contractor, or Subcontractor will be extended privileges to drive the Owner's equipment on the Owner's property if driving privileges have been withdrawn by the person's State of residence.

D. All employees will be required to sign in and out on a designated log sheet.

E. All employees shall be required to wear at all times in an observable location, above the waist, on outer clothing, an appropriate photo I.D. badge to be furnished by the Contractor and approved by the Owner.

F. No one under age sixteen is permitted at work sites after normal working hours. Contractor's employees are allowed on work sites only during the specified hours and only when working on this contract. No Contractor employee will be allowed on sites when not specifically working on this Contract's predetermined times and dates.

G. All employees and agents of the Contractor must read the Project Site Rules statement and sign a log acknowledging understanding of project site rules provided in **(Sections A & C)**.

1.10 (DWM) Contractor Badge Procedures

The ID badge will provide proof of authorization to be on the construction site, and aid DWM staff in affirming the contractor's employee has received safety training prior to the start of work at DWM project, site or facility.

A. GENERAL REQUIREMENTS

1. All individuals working on any DeKalb County Department of Watershed Management – construction projects, sites, and facilities shall be required to wear a County issued ID badge.

2. Contractors and subcontractors working on (DWM) projects, sites and facilities must have their assigned badge on their person at all times.

3. All contractors and subcontractors personnel without a current badge will not be allowed to continue to work at a (DWM) project, site or facility.

4. All workers must obtain and display an identification badge issued by the County's Safety Representative **before** reporting to work on any (DWM) construction project.

5. Although a contractor may only be required to visit our sites/property on an infrequent basis, badging is still a requirement.

6. Contractors and subcontractors vendors or their transient onsite visitors, which are not full-time employees of the site, shall be escorted while onsite as a visitor by a Department of Watershed Management badged contractor.

7. Contractors shall maintain a daily sign-in sheet/record/log of their daily workers under its supervision which includes subcontractor's vendors or their transient onsite visitors.

B. TRAINING REQUIREMENTS

1. Contractor and subcontractor employees are required to attend safety training prior to receiving a badge.

2. The **Contractor** is responsible for conduction and/or arrangement of their employee's training.

   a. OSHA 10 hour, OSHA 30 hour or project site-specific safety training along with the contractor receiving a copy of DeKalb County Project Site Rules will suffice the training requirements to receive a badge and start work on the (DWM) construction project(s), site or facility.

   b. OSHA 10 hour and 30-hour safety training received within 12 months prior to the start of work on the (DWM) construction project(s), will qualify as current.

   c. Whereas the OSHA 10 hour and 30-hour training does not expire, the actual date of training must be less than 12 months prior to the start of work on the (DWM) construction project(s) to qualify as "current,"

   d. In the case where the OSHA 10 hour and 30-hour date of training are more than 12 months prior to the start of work on the (DWM) construction project(s), project site-specific safety verification of training is required.

   e. Contractor's training should include general construction safety and the specific safety concerns/hazards employees may encounter at the Watershed Management construction site.

   f. DMW' Safety Division shall review a copy of the contractor's project site-specific safety training topics outline prior to the contractor's employees were approved for badging.

g. Contractor and subcontractor employees are required to read, understand and agree to abide by DeKalb County Project Site Rules. See **Sections A & C**.

C. VERIFICATION OF TRAINING

1. The contractor's management representative shall complete, sign and send a copy of each of their employee or their subcontractor's employee a copy of (DWM) Verification of Training Form. **See Section E.**

2. (DWM) Verification of Training Document will be sent to **VOTD@DeKalbcountyga.gov** prior to the contractor's employee badging date of appointment**.**

3. The contractor's/subcontractor's employee shall review and verify that the information on their individual (DWM) Verification of Training document is correct.

4. The contractor's employee shall also sign (DWM) Verification of Training Form verifying the information on the document is correct. The (DWM) Verification of Training Document signature statement is as follows:

"I have read, understand and agree to abide by the DEKALB COUNTY PROJECT SITE RULES. I have received a personal copy for my use and reference. Furthermore, I understand that knowingly or purposely falsifying records is grounds for being denied access to the project site."

D. VERIFICATION OF IDENTITY REQUIREMENTS

1. The contractor and subcontractor employees must provide documentation to DeKalb County to verify their identity and authorization to work.

2. DeKalb County only accepts Form I-9 acceptable documents with accompanying photo.

3. I-9 acceptable documents must be from List A and List B (Examples)

- ID cards issued by federal, state, local governmental agencies
- TWIC (Transportation Worker Identification Credential)
- Driver License or Identification card issued by a state motor vehicle department with a photo that clearly identifies the individual.

E. DWM MANAGEMENT SITE INSPECTIONS AND AUDITS

Field verification will be done randomly by the DWM Safety staff to ensure employees were trained and following County, OSHA & State regulations.

F. BADGING OFFICE ADDRESS IS AS FOLLOWS

DeKalb County Watershed Management,

Safety Division
1641 Road haven Drive, Stone Mountain, GA 30083

Badging hours are Tuesdays & Thursdays from 9:00 am to 12:00 pm.

G. BADGE EXPIRATION DATE

Badges are valid until the expiration date of the prime contractor's contract.

H. TRANSFER CONTRACTORS

If a worker changes companies or projects, the badge must be surrendered and a new badge will be issued if needed.

If applicable, the new employer will provide the employee certification that the safety training is completed.

Only those employees registered in the badging system are eligible to receive a badge,

After verification by the safety representative, the badging database will be updated and a new badge issued.

I. SPECIAL CIRCUMSTANCES:

The County can grant/permit a Contractor the right to badge their employees and subcontractors. However, the badge template shall be approved by the DWM Safety Division. The ID badge shall include the worker's name, picture, and company affiliation.

J. ADDITIONAL TRAINING REQUIREMENTS:

Additional training requirements may be requested if there is a change in the contractor's scope of work or responsibilities.

K. BADGE REPLACEMENT

The contractor must notify DMW's Safety Division immediately if a badge is lost, stolen or an employee is no longer employed with the contractor.

L. BADGE COLLECTION/ RETURN POLICY

It shall be the **Contractor's** responsibility to collect the ID badge from any employee who is discharged or resigns prior to completion of the project as well as at the completion of the project. The **Contractor** shall return the ID badges to the **DMW' Safety Division** within 48 hours of their collection. The **Contractor** shall be charged a fee of $25.00 per badge for any badges not returned at the completion of the project. For ID badges lost during the term of the project, that shall be reissued, there shall be a charge of $15.00 per ID badge. The **Contractor** shall deduct these charges from its periodic or closeout payment request or the **County** shall deduct them.

SECTION A

VISTOR ACKNOWLEDGMENT OF THE PROJECT SITE RULES

By signing this Visitor's Log, I acknowledge that I understand and agree to abide by the project rules outlined below.

In consideration of my receipt of a visitor's pass as issued by the **County** directly or indirectly for the **County**, I waive on behalf of myself, my heirs, employer, legal representatives and assigns and hereby release and discharge the **County**, each of its directors, officers, employees, representatives, and agents from any and all claims, actions, causes of action, or any charge of any kind whatsoever that may arise or could arise in the future as a result of my being present at the facility including injury, death, or property damage whether or not caused by the fault or negligence of any of the parties released hereunder.

I further acknowledge that I have been briefed on specific hazards, hazardous substances that are on site, and the site emergency action procedure.

PROHIBITED ACTIVITIES

- Unauthorized removal or theft of County property
- Violation of safety or security rules or procedures
- Possession of firearms or lethal weapons on jobsite
- Acts of sabotage
- Destruction or defacing of County property
- Failure to use sanitary facilities
- Knowingly or purposely failing to report accidents/incidents or job-related injuries
- Being under the apparent influence of drugs, alcohol, or other intoxicants or in possession of drugs, alcohol, or other intoxicants on the job site
- Wearing shorts or tennis shoes on the job site
- Failure to wear required personal protective equipment (PPE)
- Gambling, fighting, threatening behavior or engaging in horseplay on the job site
- Smoking in unauthorized areas on the job site
- Open fire cooking or making unauthorized fires on job site
- Selling items or raffles without authorization
- Use of unauthorized cameras on the job site
- Use of radio or television in the construction area
- Failure to park personal vehicle in authorized parking area
- Failure to wear designated identification [Site Specific]
- Failure to use designated gates

- Condoning or knowingly allowing a person to engage in or work around a patently unsafe or environmental compromising act or condition
- Knowingly or purposely falsifying records, documents or providing false testimony

I have read, understand, and agree to abide by the PROJECT SITE RULES. Furthermore, I understand failure to abide by these rules is grounds for being denied access to the project site. I have received a personal copy for my use and reference.

Print Name	**Signature**
Date	

SECTION B

VISITOR LOG

THE SIGNING OF THIS LOG ACKNOWLEDGES I HAVE READ, UNDERSTAND, AND AGREE TO ABIDE BY THE PROJECT RULES OUTLINED ABOVE. **THIS IS NOT A VEHICLE ACCESS PERMIT.**

NAME PRINT	SIGNATURE	COMPANY/PERSON VISITED	DATE	IN	OUT
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm
				am/pm	am/pm

SECTION C

EMPLOYEE ACKNOWLEDGMENT OF THE PROJECT SITE RULES

By signing this Employee Log, I acknowledge that I understand and agree to abide by the project rules outlined below.

PROHIBITED ACTIVITIES

- Unauthorized removal or theft of County property
- Violation of safety or security rules or procedures
- Possession of firearms or lethal weapons on jobsite
- Acts of sabotage
- Destruction or defacing County property
- Failure to use sanitary facilities
- Failure to report accidents or job-related injuries
- Under the apparent influence of drugs, alcohol, or other intoxicants or in possession of drugs, alcohol or, other intoxicants on the property
- Wearing shorts or tennis shoes on the jobsite
- Failure to wear a hardhat/safety glasses and safety vest
- Gambling at any time on the project
- Fighting, threatening behavior, or engaging in horseplay on the project
- Smoking in unauthorized areas on the project
- Open fire cooking or making unauthorized fires on project property
- Selling items or raffles without authorization
- Use of unauthorized cameras on the project
- Use of radio or television in the construction area
- Failure to park personal vehicle in authorized parking area
- Failure to wear designated identification [Site Specific]
- Failure to use designated gates

I have read, understand, and agree to abide by the PROJECT SITE RULES. Furthermore, I understand failure to abide by these rules is grounds for being denied access to the project site. I have received a personal copy for my use and reference.

Print Name	**Signature**
Date	

SECTION D

EMPLOYEE LOG

BY SIGNING THIS LOG ACKNOWLEDGMENT, I HAVE READ AND UNDERSTAND, AND AGREE TO ABIDE BY THE PROJECT RULES OUTLINED ABOVE AND ANY STATE, FEDERAL, LOCAL, OR ANY OTHER CONTRACT OBLIGATIONS THAT MAY APPLY. I FURTHER ACKNOWLEDGE THAT I HAVE BEEN ORIENTED AS TO THE SITE-SPECIFIC HAZARDS, ANY HAZARDOUS SUBSTANCES I MAY BE EXPOSED TO WHILE ON THE SITE, AND THE SITE/COMPANY EMERGENCY ACTION PROCEDURES, BY A REPRESENTATIVE OF THE COMPANY.

EMPLOYEES (PRINT)	SIGNATURE	COMPANY NAME	DATE
Signature of Company Representative:		*Date Signed:*	

SECTION E

DeKalb County Government Training Verification Form

Appointment Date: _____
(Tues./Thurs. 9am-12pm)

Primary Contractor: _____ DeKalb Contract #: _____

Subcontractor Name: _____ Contract End Date: _____

END OF SECTION

□ Course Name: Site Specific Safety Training in accordance with OSHA 29 CFR 1926 & 1910
Successfully Completed: □ Yes □ No □ In Progress
Date Completed: _____

□ Course Name: OSHA 10 Hour
Successfully Completed: □ Yes □ No □ In Progress
Date Completed: _____

□ Course Name: OSHA 24 HAZWOPER
Successfully Completed: □ Yes □ No □ In Progress
Date Completed: _____

□ Course Name: OSHA 30 Hour
Successfully Completed: □ Yes □ No □ In Progress
Date Completed: _____

□ Course Name: OSHA 40 HAZWOPER
Successfully Completed: □ Yes □ No □ In Progress
Date Completed: _____

I HAVE READ, UNDERSTAND AND I HAVE BEEN PROVIDED A COPY OF THE DEKALB PROJECT SITE RULES. FURTHERMORE, I UNDERSTAND THAT KNOWINGLY OR PURPOSELY FALSIFYING RECORDS IS GROUNDS FOR BEING DENIED ACCESS TO THE PROJECT SITE. BY MY SIGNATURE BELOW, I AFFIRM THE ABOVE INFORMATION IS ACCURATE AND TRUE TO THE BEST OF MY KNOWLEDGE.

_____ _____
Employee's Name (Print): **Employee's Name (Sign):**

_____ _____
Authorized Representative (Print): **Authorized Representative (Sign):**

SECTION 01550

TRAFFIC REGULATION

PART 1 - GENERAL

1.01 SCOPE

The Work specified in this section includes the provision of products, permits, services, procedures, and personnel by the **Contractor** to effect traffic control during the Work.

1.02 TRAFFIC CONTROL MANAGER REQUIREMENTS

A. The **Contractor** shall designate a qualified individual as the Traffic Control Manager (TCM) who shall be responsible for selecting, installing, and maintaining traffic control devices in accordance with the Plans and Specifications and the Manual of Uniform Traffic Control Devices (MUTCD). A written resume documenting the experience and credentials of the TCM shall be submitted and accepted by the **County** prior to beginning any Work that involves traffic control. The TCM shall be available on a 24-hour basis to perform his or her duties. If the Work requires traffic control activities to be performed during the daylight and nighttime hours, it shall be necessary for the **Contractor** to designate an alternate TCM. An alternate TCM shall meet the same requirements and qualifications as the primary TCM and be accepted by the **County** prior to beginning any traffic control duties. The TCM's traffic control responsibilities shall have priority over other assigned duties.

B. As the representative of the **Contractor**, the TCM shall have full authority to act on behalf of the **Contractor** in administering the Traffic Control Plan. The TCM shall have appropriate training in safe traffic control practices in accordance with Part VI of the MUTCD. In addition to the TCM, other individuals making decisions regarding traffic control shall meet the training requirements of Part VI of the MUTCD. The TCMs shall supervise the initial installation of traffic control devices. The **County,** prior to the beginning of construction, will review the initial installation. Modifications to traffic control devices as required by sequence of operations or staged construction shall be reviewed by the TCMs.

PART 2 - PRODUCTS

2.01 SIGNS, SIGNALS, AND DEVICES

A. The **Contractor** shall provide post-mounted and wall-mounted traffic control and informational signs as specified and required by local jurisdictions.

B. The **Contractor** shall provide automatic traffic control signals as approved by local jurisdictions.

C. The **Contractor** shall provide traffic cones and drums, and flashing lights as approved by local jurisdictions.

D. The **Contractor** shall provide flagmen equipment as required by local jurisdictions.

PART 3 - EXECUTION

3.01 PERMITS

A. The **Contractor** shall obtain permits from authorities having jurisdiction over road closures before closing any road. The **Contractor** shall use forms provided by authorities having jurisdiction (DeKalb County Department of Public Works, Georgia Department of Transportation, etc.).

B. The **Contractor** shall either fax or hand-carry any permit applications to the DeKalb County Department of Public Works. Permit applications shall indicate the time (in days); length (in feet); the number of lanes; and the purpose of the closure.

C. All permits are approved for operations during off-peak hours, 9:00 a.m. to 4:00 p.m., unless special approval is received from the **County**.

D. Operations between the hours of 6:00 p.m. and 10:00 p.m. and Saturdays, and Sundays shall require approval by the **County.**

E. Full street closure permits shall require 96 hours' advance notice prior to road closure. The following additional information shall be provided by the **Contractor** prior to approval:

1. The recommended detour route with signage and Traffic Management Plan as per the MUTCD.
2. A copy of the resident and/or business notification letters about the closure. The residents/businesses located between the detour routes shall be notified about the closure at least 5 business days prior to the proposed closure.

F. The DeKalb County Department of Public Works will return full road closure permit applications to the **Contractor.** The Fire Chief, Chief of Police, DeKalb Hospital, MARTA, and the DeKalb County Board of Education shall be notified in writing at least 72 hours before commencing road closure activities.

Lane closure permits are issued during operating hours Mondays through Fridays. The DeKalb County Department of Public Works will return lane closure permit applications to the **Contractor.** The **Contractor** shall provide a minimum of 48-hour notice prior to closure. The **Contractor** shall continuously maintain the safety of the traveling public during lane closures in accordance with the requirements of the MUTCD and as stipulated by public officers.

3.02 PREPARATION OF TRAFFIC CONTROL PLANS

The Traffic Control Plan drawings included with the Contract Documents shall only be considered as a guide and are not intended to contain the traffic regulation details that shall be required by the specifications, permitting agencies, and the MUTCD. The **Contractor** shall develop detailed staging and traffic control plans for performing specific areas of the Work including, but not limited to: requirements for certified flagmen, additional traffic control devices, traffic shifts, detours, paces, lane closures, or other activities that disrupt traffic flow. The **Contractor** shall submit these plans in accordance with the Specifications to receive final approvals from permitting agencies and provide required traffic control devices as required by both the permitting agencies and these specifications at no additional cost to the **County**.

3.03 CONSTRUCTION PARKING CONTROL

A. The **Contractor** shall control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and **County's** operations.

B. The **Contractor** shall monitor parking of construction personnel's vehicles in existing facilities and maintain vehicular access to and through parking areas.

C. The **Contractor** shall prevent parking on or adjacent to access roads or in non-designated areas.

3.04 MAINTENANCE OF TRAFFIC

A. Whenever and wherever, in the **County's** opinion, traffic is sufficiently congested or public safety is endangered, the **Contractor** shall furnish uniformed officers to direct traffic and to keep traffic off the highway area affected by construction operations.

B. When the Contract requires the maintenance of vehicular traffic on an existing road, street, or highway during the **Contractor's** performance of Work that is otherwise provided for in the Plans and these Specifications, the **Contractor** shall keep such road, street, or highway open to traffic and shall provide such maintenance as may be required to safely accommodate traffic. The **Contractor** shall furnish, erect, and maintain barricades, warning signs, flagmen, and other traffic control devices in conformity with the requirements of the Georgia Department of Transportation and other local jurisdictions. The **Contractor** shall also construct and maintain in a safe condition any temporary connections necessary to ingress to and egress from abutting property or intersecting roads, streets, or highways. The **Contractor** shall maintain traffic in accordance with any traffic control plans furnished with and made a part of the Plan assembly.

C. The **Contractor** shall make its own estimate of labor, materials, equipment, and incidentals necessary for providing the maintenance of traffic as specified in this section.

D. Unless specified in the Plans or these Specifications, and subject to the approval of the **County**, the cost of maintaining traffic specified in this section shall be considered incidental to the Work and no separate measurement or payment shall be made.

E. Contractor shall comply with DeKalb County Steel Plate for Residential Specification **(See Section A)**.

F. Contractor shall provide a pilot car or an escort vehicle when heavy equipment must be moved from one location to another by use of the roads, streets and through DeKalb County.

3.05 UNIFORMED POLICE OFFICER FOR TRAFFIC CONTROL

A. The **Contractor** shall provide uniformed police officers to regulate traffic when construction operations encroach on public traffic lanes, as approved by the **County**.

B. Officers shall be currently employed by a local jurisdiction, be in full uniform and have full arrest power while working.

C. Officers shall be employed and paid by the **Contractor**.

D. Officers' shall be responsible for directing traffic within the construction site.

E. Only a uniformed police officer can direct traffic when the contractor's operation interfere with or impede the operation of a traffic signal light.

3.06 FLAGMEN

A. The **Contractor** shall provide trained and equipped flagmen to regulate traffic when construction operations or traffic encroaches into public traffic lanes.

B. The contractor flagmen shall have 7' Stop/Slow paddles onsite during all operations involving traffic control.

3.07 FLASHING LIGHTS

The **Contractor** shall use flashing lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.08 HAUL ROUTES

A. The **Contractor** shall consult with authorities and establish public thoroughfares to be used for haul routes and site access.

B. The **Contractor** shall confine construction traffic to designated haul routes.

C. The **Contractor** shall provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.09 ROAD CLOSURES ON COUNTY ROADS

A. No street, road, or highway shall be closed without the permission of the owner of any street, road, or highway and the fire department having jurisdiction. Prior to closing a street, road, or highway, signs shall be posted for a minimum of 7 days prior to actual closing, forewarning of the imminent closing. The **County** shall determine the information to be placed upon the signs by the **Contractor**. Where traffic is diverted from the Work, the **Contractor** shall provide materials and perform Work for the construction and maintenance of required temporary roadways, structures, barricades, signs, and signalization.

B. To obtain approval to close a road or street maintained by the **County**, the **Contractor** shall proceed as follows:

1. The **Contractor** shall obtain approval of the traffic plan from the **County.** The traffic plan shall be in accordance with the requirements of the Georgia Department of Transportation and DeKalb County.
2. The **Contractor** shall obtain a utility permit.
3. The **Contractor** shall apply in writing to the **County** and obtain a permit to close the road on a specific date.
4. The **Contractor** shall obtain a permit from the **County** before posting closure signs. Signs shall be posted for 7 days prior to the first day of closure. Signs shall be acceptable to the **County**.
5. The **County** will handle emergency road closures.

3.10 PROCEDURES FOR TRAFFIC DETOUR ROUTE PLAN

A. The **Contractor** shall provide a sketch map to the **County,** showing the traffic detour route plan. The sketch map need not be drawn to scale, but should resemble, as closely as possible, the actual location. The sketch map shall be drawn in a manner so as to provide emergency agencies a better understanding of the detour for quick response. The sketch map shall include directional arrows showing the flow of traffic.

B. The **Contractor** shall erect “Road Closed Ahead” signs before the start point of the detour indicating the name of the street closed.

C. The **Contractor** shall erect “Detour” signs with appropriate directional arrows at intersection along the detour route until the end of the detour, when the traffic is back to the original street.

D. The **Contractor** shall erect an “End Detour” sign at the end of the detour.

E. The **Contractor** shall erect an accessory plate indicating the name of the street being detoured to accompany each “Detour” and “End Detour” sign.

F. The **Contractor** shall apply appropriate traffic control measures in accordance with the requirements of the MUTCD and **County** codes.

3.11 BARRICADES AND WARNING SIGNS

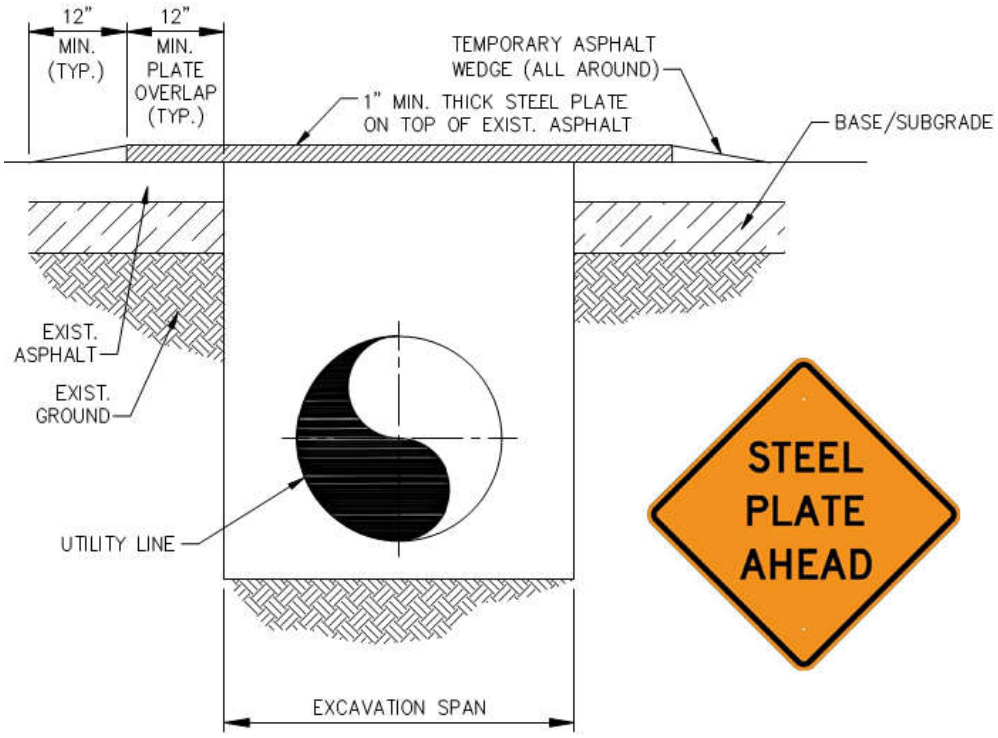
A. The **Contractor** shall furnish, erect, and maintain barricades and warning signs for hazards necessary to protect the public and the Work. When used during periods of darkness, such barricades, warning signs, and hazard markings shall be suitably illuminated or reflectorized.

B. For vehicular and pedestrian traffic, the **Contractor** shall furnish, erect, and maintain barricades, warning signs, lights, and other traffic control devices in conformity with the requirements of the Georgia Department of Transportation and DeKalb County.

C. The **Contractor** shall furnish and erect barricades and warning signs for hazards prior to commencing Work that requires such erection and shall maintain the barricades and warning signs for hazards until their dismantling is directed by the **County**.

Section A

Steel Plate Installation Urban and Residential



Notes:

1. Installation shall be used in areas where backfilling operations of an excavation in the roadway cannot meet the minimum compaction requirements and permanent patching placement within the same day.
2. All excavations shall be backfilled within the roadway.
3. Each plate is to overlap existing pavement 12” minimum in every direction and multiple plates shall abut and be secured to each other.
4. Each steel plate shall be anchored securely to prevent movement.
5. Temporary paving with a cold asphalt mix or approved equal shall be used to feather edges of the plate to form a wedged taper to cover the edges of the steel plate.
6. The steel plate shall be removed within 30 days of placement with the excavation meeting the minimum compaction requirements and permanent patching installed.
7. Any ditch line needing a steel plate longer than 30 days should have permanent patching.
8. Warning signs advising motorist that they should expect to encounter steel plates shall be placed approximately 100 feet in advance of the steel plate location. The signs shall meet MUTCD sign size requirements, shall state steel plate ahead, and shall be visible to motorist.

END OF SECTION

SECTION 01600

GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The **Contractor** shall use the latest version of the manufacturer's product line of installed materials and equipment at the time of purchase. The **Contractor** shall not purchase materials and equipment that have been outdated by newer versions at the time of purchasing. Materials and equipment that show any signs of extended storage such as corrosion, scratches, and dents shall not be accepted.

B. The **Contractor** shall use equipment for performing the Work that conforms to the latest version of applicable safety standards including, but not limited to, OSHA requirements. **Contractor** shall not exceed or ignore any requirements or recommendations of the equipment manufacturer. Equipment not meeting requirements of this Section shall be barred from use on the project.

C. The **Contractor** shall install material and equipment that meets or exceeds the latest applicable code requirements, including, but not limited to: Underwriters Laboratory, Standard Building Code, and OSHA, as well as requirements of these Specifications. Where there is conflict with requirements of the Contract Documents and code requirements, the **Contractor** shall comply with the more stringent requirements with no additional compensation to the **Contractor**.

PART 2 - MATERIALS AND EQUIPMENT

2.01 ANCHOR BOLTS

A. The **Contractor** shall use anchor bolts that are ANSI Type 316 stainless steel unless otherwise specified or indicated, and shall conform to requirements of this Section and the material articles in the appropriate Sections where they are used.

B. The **Contractor** shall use anchor bolts supplied by the manufacturer or fabricator of the specific material or equipment to be installed.

C. Design criteria for anchor bolts:

1. When the size, length, or load carrying capacity of an anchor bolt, expansion anchor, or concrete insert is not shown on the Drawings, provide the size, length and capacity required to carry the design load times a minimum safety factor of four.
2. Determine design loads as follows:
    a. For equipment anchors, use the design load recommended by the manufacturer and approved by the **County**.
    b. For pipe hangers and supports, use half the total weight of pipe, fittings, valves, accessories, and water contained in full pipe, between the hanger or support in question and adjacent hangers

and supports on both sides.

c. Allowances for vibration are included in the safety factor specified above.

d. Anchors shall develop ultimate shear and pull-out loads of not less than the following values in concrete:

Bolt Diameter (Inches)	Min. Shear (Pounds)	Min. Pull-Out Load (Pounds)
½	4,500	6,300
⅝	6,900	7,700
¾	10,500	9,900

3. Embedment depth shall be minimum 6 inches for epoxy anchors and 4 inches for steel expansion anchors, unless noted otherwise on the drawings.

D. Anchor Type and Manufacturer

1. Where epoxy anchors are noted on the drawings, provide ANSI Type 316 stainless steel threaded rod with Speed Bond #1 epoxy injection as manufactured by Prime Resins, Inc. or approved equal.

2. For other applications, provide ANSI Type 316 steel expansion anchors from one of the following manufacturers:

a. Hilti, Incorporated

b. Ramset, Incorporated

c. Approved equal

3. Install anchors per manufacturer's recommendations and this Section.

Drilled anchorage holes are to be blown out with compressed air before installing anchor.

2.02 CONNECTION BOLTS

A. Materials shall be as specified in other Sections of the Specifications, or as shown on the Drawings. Where materials are not specified or shown on the Drawings, they shall be of ANSI Type 316 stainless steel, with ANSI Type 316 stainless steel nuts and washers.

B. Unless otherwise specified, stud, tap, and machine bolts and nuts shall be ANSI Type 316 stainless steel and shall conform to the requirements of ASTM Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners, Designation A307-80. Hexagonal nuts of the same quality of metal as the bolts shall be used. Threads shall be clean cut and shall conform to ANSI Standard B1.1-1989 for Unified Inch Screw Threads (UN and UNR Thread Form).

2.03 CONCRETE INSERTS

Concrete inserts for hangers shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts for hangers shall be of a type that permits adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. Inserts shall be galvanized, then epoxy phenolic primed and top coated with PVC, using thermal bond process.

2.04 SLEEVES

A. Unless otherwise indicated on the Drawings or specified, openings for the passage of pipes through floors and walls shall be formed of sleeves of standard-weight, stainless-steel pipe. The sleeves shall be of ample diameter to pass the pipe and its insulation, if any, and to permit such expansion as may occur. Sleeves shall be of sufficient length to be flush at the walls and the bottom of slabs and to project 4 inches above the finished floor surface. Threaded nipples shall not be used as sleeves.

B. Sleeves in exterior walls below grade or in walls to have liquids on one or both sides shall be as detailed on the Approved Drawings and specified in other sections.

C. Sleeves shall be set accurately before the concrete is placed or shall be built in accurately as the masonry is being built.

2.05 ELECTRICAL EQUIPMENT ENCLOSURES

Items of electrical equipment that are furnished with process equipment shall conform to the requirements specified under the appropriate electrical sections of the specifications. Enclosures for electrical equipment such as switches, starters, etc., shall conform to the requirements specified under the appropriate electrical sections of the specifications.

2.06 EQUIPMENT DRIVE GUARDS

Equipment driven by open shafts, belts, chains, or gears shall be provided with acceptable all-metal guards enclosing the drive mechanism. Guards shall be constructed of epoxy paint coated, galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps that will permit easy removal for servicing the equipment. The guards shall conform to applicable safety codes and regulations.

2.07 NAMEPLATES

A. The **Contractor** shall provide each piece of equipment, with the exception of the items mentioned below, with a substantial nameplate of non-corrodible metal, securely fastened in place and clearly and permanently inscribed with the manufacturer's name, model or type designation, serial number, principal rated capacities, electrical or other power characteristics, and similar information as appropriate.

B. This requirement shall also apply to standard, manually operated gate, lobe, check, and plug valves.

C. Each process valve shall be provided with a substantial tag of noncorrodible metal securely fastened in place and inscribed with an identification number in conformance with the tag numbers indicated on the Process and Instrumentation Drawings.

2.08 LUBRICANTS

During testing and prior to acceptance, the **Contractor** shall furnish lubricants necessary for the proper lubrication of equipment furnished under this Contract.

2.09 PROTECTION AGAINST ELECTROLYSIS

Where dissimilar metals are used in conjunction with each other, the **Contractor** shall provide suitable insulation between adjoining surfaces to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators, or washers, or other approved acceptable materials.

2.10 TRANSPORTATION, HANDLING, STORAGE, AND PROTECTION

A. Packing and Shipping:

1. Product and materials shall be shipped and handled in ways that shall prevent damage.
2. Equipment shall be protected against damage from moisture, dust, handling, or other cause during transport from manufacturer's premises to the project site. Bearing housing, vents, and other types of openings shall be wrapped or otherwise sealed to prevent contamination by grit and dirt.
3. Ship equipment, material, and spare parts in assembled units except where partial disassembly is required by transportation regulations or for protection of components.
4. Pipe and appurtenances shall be handled, stored, and installed as recommended by the manufacturer. Pipes shipped with interior bracing shall have the bracing removed only when recommended by the pipe manufacturer.
5. Stiffeners shall be used where necessary to maintain shapes and to give rigidity.
6. Each item or package shall be marked with the number unique to the specification reference covering the item. Spare parts shall be packed in containers bearing labels clearly designating contents and pieces of equipment for which intended.

B. Acceptance at Site:

1. Damaged items shall not be permitted as part of the Work except in cases of minor damage that have been satisfactorily repaired and are acceptable to the **County**.

2. Damage shall be corrected to conform to the requirements of the Contract before the assembly is incorporated into the Work.

3. The **Contractor** shall bear the costs arising out of dismantling, inspection, repair, and reassembly.

C. Storage and Protection:

1. During the interval between the delivery to the site and installation, equipment and materials shall be stored in an enclosed space affording protection from weather, dust, and mechanical damage and providing favorable temperature, humidity, and ventilation conditions to protect against equipment deterioration. Manufacturer's recommendations shall be adhered to in addition to these requirements.

2. Equipment and materials to be located outdoors may be stored outdoors if protected against moisture condensation and ultraviolet (UV) degradation. Equipment shall be stored at least 6 inches above ground. Temporary power shall be provided to energize space heaters or other heat sources for control of moisture condensation. Space heaters or other heat sources shall be energized without disturbing the sealed enclosure.

2.11 UNIT RESPONSIBILITY

A. Equipment systems made up of two or more components shall be provided as a unit by the responsible manufacturer. Unless otherwise specified, the **Contractor** shall obtain each system from the supplier of the driven equipment, and the supplier shall provide components of the system to enhance compatibility, ease of construction, and efficient maintenance. The **Contractor** shall be responsible to the **County** for performance of systems in accordance with the provisions of the General Requirements of the Contract Documents.

B. Where the detailed specifications require the **Contractor** to furnish a certificate of unit responsibility, such certificate shall be executed by the manufacturer. No other submittal material shall be processed until the Certificate of Unit Responsibility has been received and has been found to be satisfactory.

END OF SECTION

SECTION 01610

TRANSPORTATION AND HANDLING

PART 1 - GENERAL

1.01 SCOPE

A. The **Contractor** shall provide transportation of equipment, materials, and products furnished under these Contract Documents to the Work site. In addition, the **Contractor** shall provide preparation for shipment, loading, unloading, handling, and preparation for installation, as well as other Work and incidental items necessary or convenient to the **Contractor** for the satisfactory prosecution and completion of the Work.

B. Equipment, materials, and products damaged during transportation or handling shall be repaired or replaced by the **Contractor** at no additional cost to the **County** prior to being incorporated into the Work. Acceptance of damaged goods is at the discretion of the **County**.

1.02 TRANSPORTATION

A. Equipment shall be suitably boxed, crated, or otherwise protected during transportation.

B. Where equipment will be installed using existing cranes or hoisting equipment, the **Contractor** shall confirm that the weights of the assembled sections do not exceed the actual capacity of the cranes or hoisting equipment.

C. Small items and appurtenances such as gauges, valves, switches, instruments, and probes that could be damaged during shipment shall be removed from the equipment prior to shipment, packaged, and shipped separately. Openings shall be plugged or sealed to prevent the entrance of water or dirt.

1.03 HANDLING

A. Equipment, materials, and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation.

B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Eyebolts or lifting lugs furnished on the equipment shall be used in handling the equipment. Shafts and operating mechanisms shall not be used as lifting points. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds that permitted by standard industry practice.

C. Under no circumstances shall equipment or products such as pipe, structural steel, castings, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground.

D. Slings and chains shall be of size and capacity rating to safely support the weights of items to be unloaded. Slings and chains shall be regularly inspected and tagged as in good conditions in accord with OSHA requirements. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures
2. Final completion procedures
3. Warranties
4. Final cleaning
5. Repair of the Work
6. Specific closeout and special cleaning requirements for the Work in those Sections

1.03 SUBMITTALS

Submit the following shop drawings in accordance with **Section 01300 - Submittals**:

A. Product Data: For cleaning agents.

B. **Contractor's** List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

D. Certificates of Release: From authorities having jurisdiction.

E. Certificate of Insurance: For continuing coverage.

F. Field Report: For pest control inspection.

G. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.04 SUBSTANTIAL COMPLETION PROCEDURES

A. **Contractor's** List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (**Contractor's** punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following: a minimum of (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting **County** unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.

3. Submit closeout submittals specified in individual Divisions 02 through 16 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Submit maintenance material submittals specified in individual Divisions 02 through 16 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by the **County.** Label with manufacturer's name and model number where applicable.

   a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain the signature of an authorized **County** representative for receipt of submittals.

5. Submit test/adjust/balance records.

6. Submit sustainable design submittals required in Division 01 (sustainable design requirements Section) and in individual Division 02 through 16 Sections.

7. Submit changeover information related to **County's** occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following: a minimum of (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise the **County** of pending insurance changeover requirements.

2. Make final changeover of permanent locks and deliver the keys to **County**. Advise the **County's** personnel of changeover in security provisions.

3. Complete startup and testing of systems and equipment.

4. Perform preventive maintenance on equipment used prior to Substantial Completion.

5. Instruct **County's** personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section - Training.

6. Advise **County** of changeover in heat and other utilities.

7. Participate with **County** in conducting inspection and walkthrough with local emergency responders.

8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

9. Remove labels that are not permanent labels.

10. Complete final cleaning requirements, including touchup painting.

11. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, **County** will either proceed with inspection or notify **Contractor** of unfulfilled requirements. **County** will prepare the Certificate of Substantial Completion after inspection or will notify **Contractor** of items, either on **Contractor's** list or additional items identified by **County**, that shall be completed or corrected before certificate shall be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

2. Results of completed inspection shall form the basis of requirements for final completion.

1.05 STARTING OF SYSTEMS

A. Conform to the requirements of sections within Division 1.

B. Coordinate schedule for start-up of various equipment and systems.

C. Notify **County** (seven) days prior to start-up of each item.

D. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

E. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

F. Verify wiring and support components for equipment are complete and tested.

G. Execute start-up under supervision of applicable manufacturer's representative, **Contractors'** personnel, and **County** in accordance with manufacturers' instructions.

H. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, approve equipment or system installation prior to start-up, to supervise placing equipment or system in operation, and to train the **County's** staff.

1.06 DEMONSTRATION AND INSTRUCTIONS

A. Conform to the requirements of **Sections 01640 - Manufacturer's Services** and **01650 - Facility Startup**.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within (six) months.

C. Utilize operation and maintenance manuals as the basis for instruction. Review contents of manual with **County's** personnel in detail to comprehensively explain the operation and maintenance.

D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at a scheduled and agreed time, for each piece of equipment at each designated location. Time shall be acceptable to the **County**.

E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

F. Required instruction time for each item of equipment and system is specified in individual sections.

1.07 TESTING, ADJUSTING, AND BALANCING

A. **County** shall appoint and employ services of independent firm to perform testing, adjusting, and balancing to ensure smooth and unhindered equipment operation. **Contractor** shall pay for services and funds shall be within the contract price.

Reports shall be submitted by independent firm to **County** indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.

1.08 PROJECT RECORDS DOCUMENTS

A. The **Contractor** shall record any actual revisions to the Work and maintain one set of the following Project Record Documents on Site:

1. Contract Drawings, Specifications, and Addenda.

2. Change Orders, Field Orders, and other written notices.

3. Shop drawings, Product data, and samples.

4. Records of surveying and layout Work.

5. Project Record Drawings.

B. The **Contractor** shall record information on the Project Record Documents concurrent with construction progress and store these documents separately from the documents used for construction.

1. The **County** will supply a set of Contract Drawings. The **Contractor** shall mark thereon each revision as the Work progresses in order to produce a set of as-built drawings.

2. The **Contractor** shall note any changes made during construction by any of the **Contractor's** forces or those of any subcontractors.

3. The **Contractor** shall dimension the locations of buried or concealed Work, especially piping and conduit, with reference to exposed structures.

4. The **Contractor** shall note the installed locations of concealed service lines on the Site or within the structure by reference from the center line of the service to the structure column lines, to other main finished faces, or to other structural points that are easily identified and located in the finished Work.

5. Certificates of Substantial Performance and Total Performance shall not be issued until as-built drawings are complete and submitted, and the **Contractor** has fully satisfied the requirements for Substantial Performance and Total Performance of the Work.

C. For Project Record Documents and Record Shop Drawings, the **Contractor** shall legibly mark each item to record actual construction, including:

1. Field changes of dimensions and details.

2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

3. Measured locations of internal utilities and appurtenances that are concealed in construction, referenced to visible and accessible features of the Work.

4. Any Changes in the Work from the contract documents.

5. The location of concealed mechanical services and electrical main feeders, junction boxes, and pullboxes.

D. Upon completion of the Work, the **Contractor** shall prepare two DVD-ROM or USB thumb drive sets of the Record Shop Drawings and an index.

E. The **Contractor**-prepared Record Shop Drawings DVD-ROM index shall identify the **County's** project number, project name, and Contract number and the contents of each DVD in the format listed below.

1. The index shall include the following columns of information for each Record Shop Drawing:

    a. DVD number

    b. Specification Section number

    c. Specification title

    d. Shop drawing transmittal number

    e. Shop drawing equipment description including preselected Equipment vendor and supplier.

2. The index shall be printed by the following two sorts:

    a. Primary sort: Specification Section number. Secondary sort: shop drawing transmittal number.

    b. Primary sort: DVD number. Secondary sort: Specification Section number.

3. The index shall be generated using Microsoft Excel software. A copy of the electronic file shall be furnished to the **County**.

4. The **Contractor** shall provide a set of Project Record Documents on DVD-ROM or USB thumb drive in an electronic format compatible with the plant DVD-ROM record standards. All drawings are to be provided electronically on DVD-ROM in both AutoCAD (latest version) and Adobe Acrobat PDF (latest version). Also provide a set of DVD-ROMs containing the software implemented on this project, including standard software and custom application software. Also provide a set of DVD-ROMs containing the various programming tools and files necessary for maintenance, editing, backing up, and restoring programmable equipment implemented on this project.

1.09 EQUIPMENT INVENTORY SPREADSHEET

A. As part of the **County's** asset management program, the **Contractor** shall complete each field for the equipment inventory file for each piece of equipment and device provided under this Contract, as a requirement for Substantial Performance. An electronic format of the equipment inventory spreadsheet shall be provided on a DVD by the **Contractor**.

1.10 EQUIPMENT PREVENTIVE MAINTENANCE SPREADSHEET

A. As part of the **County's** asset management program, the **Contractor** shall complete each field for each piece of equipment and device provided under this Contract, as a requirement for Substantial Completion. The **Contractor** shall transfer the manufacturer's recommended preventive maintenance tasks and frequencies into the spreadsheet. An electronic format of the equipment inventory spreadsheet shall be provided on a DVD by the **Contractor.**

1.11 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting them with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.12 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to location as directed by **County**; obtain receipt prior to final payment.

C. Crate in containers designed for prolonged storage suitable for handling with hoisting equipment containers:

D. Stencil on containers:

1. Manufacturer/supplier name
2. Unit name
3. Spare part name
4. Manufacturer catalog number
5. Other identifying information
6. Precautionary information

1.13 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1.
2. Certified List of Incomplete Items: Submit certified copy of **County's** Substantial Completion inspection list of items to be completed or corrected

(punch list), endorsed and dated by **County's** representative**.** Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of the request, the **County** will either proceed with inspection or notify the **Contractor** of unfulfilled requirements. The **County** will prepare a final Certificate for Payment after inspection or will notify the **Contractor** of construction that shall be completed or corrected before the certificate will be issued.

C. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete has been completed or corrected.

1.14 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction, including, if necessary, areas disturbed by the **Contractor** that are outside the limits of construction.

1. Organize the list of spaces in sequential order, starting with exterior areas first, and proceeding from the lowest floor to highest floor.

2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Include the following information at the top of each page:

   a. Project name

   b. Date

   c. Name of **Contractor**

   d. Page number

4. Submit list of incomplete items in the following format:

   a. PDF electronic file. **County** will return annotated file.

   b. Three paper copies. **County** will return two copies.

1.15 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of the **County** for designated portions of the Work where commencement of warranties other than the date of

Substantial Completion is indicated, or when a delay in submittal of warranties might limit the **County's** rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of the Work that are completed and occupied or used by **County** during the construction period, by separate agreement with **Contractor**.

C. Organize warranty documents into an orderly sequence based on the table of contents of Contract Documents.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper or as directed by the **County.**

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of **Contractor**.

4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the Georgia Code of Regulations maximum allowable volatile organic compound (VOC) levels.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Perform final cleaning as directed by the **County.**

B. Pest Control: Comply with pest control requirements in Division 01, Section, Temporary Facilities and Controls. Prepare and submit a written report to the **County**.

C. Construction Waste Disposal: Comply with waste disposal requirements in Division 1 and meet local laws.

3.02 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determining Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.

2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration. Do not paint over "UL" or other required labels and identification, including mechanical and electrical nameplates. Remove any paint that has been applied to required labels and identification.

3. Replace parts that have been subjected to operating conditions during construction that could impede operation or reduce longevity.

4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

3.03 ADJUSTING

Adjust operating products and equipment to ensure smooth and unhindered operation.

END OF SECTION

SECTION 01800

MAINTENANCE

PART 1 - GENERAL

1.01 DESCRIPTION

A. **Contractor** shall maintain stored and installed equipment and materials until Final Acceptance of the Work as defined by the General Requirements. Work includes, but is not limited to:

1. Perform required maintenance.

2. Repair and maintain protective coatings.

3. Repair and replace scratched and damaged materials and equipment.

4. Maintain and operate new equipment placed into service.

B. Work, per this Section, starts on the date the equipment and materials are received and continue until the Date of Final Acceptance.

C. **Contractor** shall monitor equipment storage, and subsequently, the operation and material functionality on a continual basis during the specified time period. Deterioration of materials or malfunction of equipment shall be followed by swift repair action to minimize the damage. Such repair shall include repair and technical services by an independent contractor if the **County** deems the **Contractor's** efforts are ineffective at correcting the problem.

D. All costs for maintenance and repair of stored and installed equipment and materials, including costs from an independent contractor, during the specified time period shall be the sole responsibility of the **Contractor**.

END OF SECTION 01800

SECTION 02000
SITE WORK

PART 1 - GENERAL

1.01 DESCRIPTION

These general site work requirements apply to all site work operations. Refer to specification sections for specific product and execution requirements.

1.02 QUALITY ASSURANCE

A. Comply with all applicable local, state, and federal requirements regarding materials, methods of work, and disposal of excess and waste materials.

B. Obtain and pay for all required inspections, permits, and fees. Provide notices required by governmental authorities.

1.03 PROJECT CONDITIONS

A. Locate and identify existing underground and overhead services and utilities within contract limit work areas. Provide adequate means of protection of utilities and services designated to remain. Repair utilities damaged during site work operations and all cost associated with the damaged utility are the **Contractor's** expense.

B. Arrange for disconnection disconnect and seal or cap all utilities and services designated to be removed or abandoned before start of site work operations. Perform all work in accordance with the requirements of the applicable utility company or agency involved.

C. When uncharted or incorrectly charted underground piping or other utilities and services are encountered during site work operations, notify the **County** and the applicable utility company immediately to obtain procedure directions. Cooperate with the applicable utility company in maintaining active services in operation.

D. Locate, protect, and maintain benchmarks, monuments, control points, and project engineering reference points. Reestablish disturbed or destroyed items at the **Contractor's** expense.

E. Perform site work operations and the removal of debris and waste materials to assure minimum interference with streets, walks, and other adjacent facilities.

F. Obtain governing authorities' written permission when required to close or obstruct street, walks, and adjacent facilities. Provide alternate routes around closed or obstructed traffic ways when required by governing authorities.

G. Control dust caused by work. Dampen surfaces as required. Comply with pollution control regulations of governing authorities.

H. Protect existing buildings, paving, and other services or facilities on site and

adjacent to the site from damage caused by site work operations. Cost of repair and all cost associated with the damages including restoration of damaged items are at Contractor's expense.

I. Protect and maintain streetlights, utility poles and services, traffic signal control boxes, curb boxes, valves and other services, except items designated for removal. Remove or coordinate the removal of traffic signs, parking meters, and postal mailboxes with the applicable governmental agency. Provide for temporary relocation when required to maintain facilities and services in operation during construction work.

J. Preserve from injury or defacement all vegetation and objects designated to remain.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

Materials and equipment: As selected by the **Contractor**, except as indicated in contract documents.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine the areas and conditions under which site work is performed. Do not proceed with the work until unsatisfactory conditions are corrected.

B. Consult the records and drawings of adjacent work and of existing services and utilities that may affect site work operations.

+++ END OF SECTION 02000 +++

SECTION 02020
USE OF EXPLOSIVES

PART 1 - GENERAL

1.01 SCOPE

A. This section covers the use of explosives and blasting. Limit the use of explosives in the work to the practicable minimum by utilizing mechanical means of excavation to the maximum feasible extent. Blasting shall be limited and shall be approved by the **County**.

B. Related Work Specified Elsewhere:

1. Section 01380 - Photographic Documentation
2. Section 02000 - Site Work
3. Section 02140 - Dewatering
4. Section 02200 - Earthwork
5. Section 02324 - Trenching and Trench Backfill

C. Definitions:

Controlled blasting is excavation of rock in which the blast hole size, spacing, depth and burden, and the charge size, depth and delay sequence are carefully planned and controlled to excavate the rock to the required limits. Controlled blasting minimizes overbreak and fracturing of the rock beyond the design lines.

1.02 GENERAL

A. Perform blasting only with permits from the appropriate jurisdictional agencies. Necessary permits include an Explosives License issued by the Georgia Safety Fire Commissioner, and users' permits obtained from DeKalb County. Obey all local, State, Federal and other Governmental regulations applying to transportation, handling, storage and use of explosives, including the requirements of the DeKalb County Fire Department, the State of Georgia and applicable regulations of the Occupational Safety and Health Administration.

B. Perform blasting operations in trenches, shafts and other open excavations only during daylight hours. Perform blasting operations only during the hours 7:00 a.m. to 10:00 p.m. No blasting shall be performed on Saturdays, Sundays or on the public holidays observed by the **County**. If an emergency prevents a blast being fired during the permitted hours and the holes are loaded, the blast shall be fired as soon as safety allows. In the event that blasting is found necessary outside the permitted hours, the **Contractor** shall receive approval from the County and inform local residents within hearing and vibration range and the jurisdictional agencies prior to firing.

C. Furnish, install and operate at each site where blasting is being performed, using electric methods of initiation, an approved short-range, high accuracy

thunderstorm monitor and lightning warning system. System shall be constantly be monitoring the electrical field of the atmosphere for pre-emptive notification of nearby lightning strikes. The system shall connect to system lighting and audible devices to alert of incoming lightning activity. The system shall have the capability to send test messages and email alert notifications. The system shall have adequate provisions for transmitting alarms from the device to all locations where preparation for blasting, using electric initiation, are in progress. Install and maintain the system in accordance with the manufacturer's recommendations. Test the entire monitoring and alarm system for satisfactory operation at intervals not exceeding two (2) weeks, and suspend blasting operations until any defects have been corrected.

D. Employ the services of a blasting consultant, satisfactory to the **County** and experienced in predicting and evaluating the effects of blasting on nearby structures, such that vibration levels at these structures do not exceed a level that will damage the structures or their contents, or cause undue alarm to their occupants. Employ the blasting consultant to plan and evaluate blasting operations.

E. Preconstruction Video Survey and Inspections

1. **Contractor** is expressly advised that the protection of buildings, structures, bridges, utilities, and related work adjacent and in the vicinity of its operations, wherever they may be, is solely its responsibility. Existing condition inspection of buildings, bridges or other structures in the immediate vicinity of any blasting operations shall be performed by and be the responsibility of the **Contractor**. The inspection corridor shall extend within a 500-foot radius of all proposed blasting operations. The **Contractor** shall retain an independent consultant, specializing in preconstruction surveys, to conduct the required inspections. The video survey and inspections shall conform to the requirements of Section 01380 - Photographic Documentation.

2. Prior to the start of blasting operations, the **Contractor** shall have the independent preconstruction survey consultant, make an examination of the interior and exterior of the adjacent structures, buildings, facilities, etc., and record by notes, measurements, photographs, etc., conditions which might be aggravated by blasting or other operations. Repairs or replacement of all conditions disturbed by the construction shall be made to the satisfaction of the owners or agents of adjacent buildings, structures, facilities, etc., and to the satisfaction of the **County**. This does not preclude conforming to the requirements of the insurance underwriters. Two (2) copies of surveys, photographs, videos, reports, etc., shall be submitted to the **County**.

3. The cost of all pre-construction video surveys and inspections shall be borne by the **Contractor**.

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements Conditions of the Contract Documents and Section 01300. In addition, the following specific information shall be provided:

1. At least sixty (60) days prior to commencement of blasting operations, a copy of all applicable licenses and permits for the purchase, transportation, storage and use of explosives.

2. At least sixty (60) days prior to commencement of blasting operations, a Blasting Monitoring Plan that shall include:
   i. Name of the Blasting Vibration Consultant who shall be responsible for establishing the monitoring program and interpreting the vibration readings;
   ii. Names of the trained personnel provided to operate the monitoring equipment; the type and model of blasting seismograph proposed for use;
   iii. Number and location of proposed monitoring stations; the methods to be used to coordinate blast detonation with recording of the blast; and
   iv. Steps to be taken if blasting vibrations exceed or seem likely to exceed the vibration limits.
   v. Name, make, and model of the short-range, high accuracy thunderstorm monitor and lightning warning system, including details on the alert warning system.

3. At least sixty (60) days prior to any blasting operation, provide:
   i. Initial blast design for that location including number, location, diameter, depth and inclination of drill holes on a scale drawing of the excavation or heading face;
   ii. Type and weight of explosive in each hole; delay arrangement showing delay period in each hole; total weight of explosive in the blast and maximum charge per delay; the method of detonation; calculations of peak particle velocities and air blast overpressures; and the precautions to be taken to prevent flying rock or other debris.
   iii. Manufacturers' data sheets shall be provided for all explosives and accessories to be used.
   iv. Name and qualifications of the independent preconstruction survey consultant.
   v. Preconstruction Video Survey and Inspections.
   vi. Written controlled blasting techniques.

4. At least thirty (30) days prior to any blasting operation, provide Blasting Safety Plan including:
   i. Health and Safety requirements of all governing legislation;
   ii. Certificates from all regulating agencies and relevant insurance companies;
   iii. Outline of safety training program for the **Contractor's** and **County's** personnel;
   iv. Communication and warning procedures;

v. Samples of all report and inspection forms; and lightning protection plan.

5. Within the working day following each blast, the **Contractor** shall provide the blasting records and information for each blast detonated:
   a. A complete description including the location, date and exact time of the blast; name and signature of person in responsible charge of loading and firing and their blaster permit number; details of each blast as listed above for the initial blast design and any departures from the blast design; comments regarding any misfires, unusual results or unusual effects; any other records required by applicable regulations; and the name and signature of the person preparing the report.

   b. The monitoring record including the location, date, and exact time of the blast; general weather conditions; the locations of seismographs and type of ground on which they were located, instrument identification and their distances from the blast; the measured peak particle velocities; air blast overpressure records, if appropriate; and the name and signature of the observer.

1.04 QUALITY ASSURANCE

Work Experience:

A. The blasting consultant shall have at least ten (10) years of blasting experience. The blasting consultant shall be on call throughout the entire period that blasting is performed and shall be available at the site within two (2) days at any time that the blasting consultant's services may be necessary as determined by the **County**.

B. Blasting supervisors shall have a minimum of five (5) years' experience in supervising the loading and firing of charges for the excavation of shafts and trenches and shall have all necessary licenses and permits required by the appropriate jurisdictional agencies.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use only non-nitroglycerine explosives.

B. Store explosives and detonators in the manufacturers' boxes with date codes to allow the **County** to determine their age of the materials. All explosives and detonators used in the work shall be less than one (1) year old. Blasting products shall not be brought onto the site if the date codes are missing. When in the **County's** opinion any blasting product is either of excessive age or in a deteriorated condition, that material shall not be used until its age or quality can be shown to be satisfactory.

2.02 EQUIPMENT

A. Use dust suppressant measures with air-powered or air-flush rock drilling equipment.

B. Wet down the muck pile after blasting to control dust during mucking operations.

PART 3 - EXECUTION

3.01 GENERAL

A. Firing shall be permitted only after the proper precautions have been taken for the protection of all persons, work, and property.

B. The following limits on peak particle velocities and air blast overpressure, or such lower limits as established by the **Contractor's** Blasting Vibration Consultant, shall apply:

1. At structures and utilities in the vicinity of blasting operations, the peak particle velocity resulting from blasting shall not exceed:

   a. Frequency < 3 Hz: 0.2 inches/second.
   b. Frequency 3 - 10 Hz: 0.5 inches/second.
   c. Frequency 10 - 40 Hz: varying linearly 0.5 to 1.0 inches/second.
   d. Frequency > 40 Hz: 1.0 inches/second.

   The above limits are adopted from modified blasting level criteria given in U.S. Bureau of Mines Recommendations RI-8507.

2. In the permanent concrete work, the peak particle velocities resulting from blasting shall not exceed two (2) inches per second.

3. At the nearest structure subject to damage from air blast overpressure, the mean peak air blast overpressure shall not exceed 0.01 psi. Measure readings for peak particle velocity in three (3) orthogonal directions by equipment approved by the **County** that is either continually recording or triggered by a preset level of vibration. Determine particle velocity in each frequency range by spectral analysis. Zero crossing method to determine frequency is not acceptable.

C. Blasting within fifty (50) feet of permanent concrete work may be permitted only after approval of the **Contractor's** plans showing the relative positions of the concrete, the area to be blasted and the blasting technique to be employed. All concrete work shall be protected by limiting the size of blasts, covering blasts and by other means until it is established that there is no danger of damage caused by either vibration or flying rock.

D. Exercise all possible care in drilling and blasting operations to ensure the stability of the remaining rock and to keep overbreak to a minimum. Written controlled

blasting techniques to be used shall be submitted to the **County** for approval.

E. At each work site where blasting is being performed, erect signboards of adequate size stating that blasting operations are taking place in the work site and such signs shall be clearly visible at all points of access to the work site.

F. Monitor the first blast at each location as a test case, and modify the initial blast design for that location if the monitoring record indicates that the vibration and air blast overpressure limits were exceeded or may be exceeded in subsequent blasts. Resubmit the blast design to the **County**. Continue vibration recording and air blast overpressure monitoring for every blast, and further adjustments to the blast design shall be made when the records indicate vibration or air blast overpressure in excess of the established limits.

G. Before the firing of any blast where flying material may result in damage to persons, property, or the work, cover the rock to be blasted with suitable matting and overburden to prevent flying debris. After a blast is fired, remove all loose and shattered rock or other loose material that may endanger the structure or the workers, and make the excavation safe before continuing with the work. Carry out similar checks on previously excavated sections at least every 48 hours and recheck the support system, tightening lagging, and blocking, and adding rock dowels, mesh and other support measures as required. Before drilling new blast holes, thoroughly clean the face and examine the face for holes containing undetonated explosive.

H. In the event that damage occurs due to blasting work, suspend all blasting immediately and make a report to the **County**. Before resuming blasting, adjust the blast design and resubmit it to the **County**, and take any other appropriate measures to control the effects of blasting.

I. If blasting causes excessive overbreak or excessive fracturing of the surrounding rock, or is otherwise detrimental to the work, modify the blast design as necessary to achieve the desired result, and resubmit it to the **County**.

+++ END OF SECTION 02020 +++

SECTION 02050
DEMOLITION

PART 1 - GENERAL

1.01 SCOPE

A. General:

1. This section covers the labor, equipment, and materials necessary for the work associated with the demolition or removal of pipes, manholes, catch basins, pavement, houses, and other structures within the construction easements shown on the Plans, including all necessary excavation and backfilling.

2. Where removing structural tile and brick from existing structures, the work shall include all patching and reconditioning to restore the remaining tile or brick to its existing state and to provide a proper joint for joining the existing to new construction.

3. Where concrete is cut from existing structures under this Section to permit setting or inserting pipes, flumes, equipment or appurtenances, the work shall include all re-concreting, dressing and finishing of openings to the required lines and dimensions or as necessary for the placing and fixing of inserts. This repair is to meet all structural and leakage requirements and shall use non – shrink material.

4. The **Contractor** shall remove from existing structures and salvage, store or dispose of as specified hereinafter, all valves and piping, mechanical equipment, plumbing, heating, electrical, and ventilating fixtures, pipes, ducts, wires, and equipment, doors and windows, floor grating and cover plates, steel stairs, pipe railing, and the like that are not to remain in service in the finished work, whether or not shown on the Drawings and/or specified herein.

5. The work specified herein and shown on the Drawings is intended to give a general idea of the scope of this work but shall not be construed as covering it entirely. The **Contractor** shall visit the site and judge the amount of work required and the problems anticipated in the performance of the work.

6. Requirements for removal and abandonment of site utilities are specified in Section 02000.

B. Asbestos Abatement:

1. The **Contractor** shall furnish all labor, materials, facilities, equipment, services, employee training and testing, and waste transportation and disposal for the removal of asbestos-containing materials (ACM) at the

site of the Work. Asbestos could possibly be encountered in demolition of houses, structures, and piping to be demolished.

2. All asbestos removal work shall be performed in accordance with the requirements established by the EPA, OSHA, Georgia Department of Transportation, NIOSH and State of Georgia EPD regulations; and any other applicable Federal, State and local regulations governing ACM abatement. Whenever there is a conflict or overlap of the above references, the most stringent provisions shall apply.

3. The **Contractor**, or an asbestos abatement subcontractor acceptable to the **County**, shall be licensed in Georgia to perform asbestos abatement and meet other qualification requirements specified in this section. The **Contractor** shall include a program for protective equipment, breathing apparatus, work area security, and all other aspects dealing with health and safety in his Health, Safety, and Security Plan. This information may be called for elsewhere in these Specifications, however a submittal is required.

C. Related Work Specified Elsewhere:

1. Section 01210 - Measurement and Payment
2. Section 02000 - Site Work
3. Section 02200 - Earthwork

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300 Submittals. In addition, the following specific information shall be provided:

1. The **Contractor** shall submit to the **County** a schedule of demolition, detailed methods of demolition to be used for each structure, copies of authorization, and permits to demolish the structures.

PART 2 - PRODUCTS

2.01 GENERAL

A. The **Contractor** shall provide all materials and equipment in suitable and adequate quantities as required to accomplish demolition work.

PART 3 - EXECUTION

3.01 SAFETY REQUIREMENTS

A. All work shall be performed in conformance with the laws and regulations pertaining to safety established by Federal, State, and local governments and other authorities having jurisdiction.

3.02 UTILITIES

A. The **Contractor** shall be responsible for maintaining all appropriate utility services during the demolition operations.

B. Sewer lines shall be removed or grouted for their entire lengths, and plugged at both ends with concrete to prevent groundwater infiltrating into the sewer line.

C. Total shutdown of the existing utilities to perform any new construction, to make the required structural or piping modifications, and/or to make or install the required service or system modifications, shall not be permitted, except by written request and approval of the **County**.

D. Prior to making any piping or connections or modifications to existing facilities, the **Contractor** shall obtain specified timing and schedule approval from the **County**.

3.03 EQUIPMENT TO BE SALVAGED BY THE **COUNTY**

A. The following is a partial list of materials to be removed and salvaged. The **County** will identify other materials to be salvaged during the course of the Work. Equipment on this list shall be removed by the **Contractor** before the demolition work begins and delivered to a site specified by the **County**.

1. Frames, Grates, and Manhole Covers
2. Fire Hydrants
3. Valves
4. Pumps
5. Meters
6. Backflow Devices

3.04 REMOVAL AND STORAGE OF EQUIPMENT FOR REUSE

A. No structure shall be removed without the approval and consent of the **County** unless shown on the Plans to be removed. The **Contractor** shall maintain all equipment in the same condition as when it was removed. The condition of the structure shall be determined prior to removal by the **County**. The **Contractor** assumes the responsibility for assuring that the material is properly stored and maintained.

3.05 DEMOLITION

A. The Plans define the portion of the structures to be removed. Unless otherwise shown on the Plans, the **Contractor** shall not make rough cuts or breaks that exceed the limits of demolition shown.

B. All equipment, materials, and piping, except as specified hereinbefore, within the limits of the demolition shall become the property of the **Contractor**.

3.06 REMOVAL OF EXISTING PIPING

A. Where existing piping is in conflict with new piping or construction, rerouting or redesign shall be as directed by the **County**.

3.07 REMOVAL OF ASBESTOS-CONTAINING MATERIALS

A. The **Contractor** shall provide all services to perform the work as follows:

1. Remove asbestos containing materials as required by applicable codes and regulations.

2. Isolate each work area and erect temporary staging, containment barriers, and decontamination facilities as required.

3. Remove all ACM from the work area.

4. Thoroughly clean each work area and perform clearance air testing using NIOSH Method 7400.

5. Remove all temporary staging, partitions, and other items installed to perform the work.

6. Dispose of ACM in accordance with applicable Federal, State, and local laws and regulations.

3.08 BACKFILLING

A. The **Contractor** shall backfill all demolished areas to existing ground level as to create positive sheet runoff.

B. Backfill material shall meet the minimum requirements of Section 02200 - Earthwork. Backfill compaction shall be in accordance with the applicable requirements of Section 02324 – Trenching and Trench Backfilling and Section Structures. Rock and debris shall not be used as backfill material. In all areas not backfilled to ground level, the **Contractor** shall erect safety barriers around the excavation and not allow water to accumulate.

3.09 DISPOSAL OF DEMOLITION DEBRIS

A. The **Contractor** shall dispose of demolition debris in accordance with the requirements of Section 02000 - Site Work.

+++ END OF SECTION 02050 +++

SECTION 02060
CRUSHED STONE AGGREGATE

PART 1 - GENERAL

1.01 SCOPE

A. This section includes installation of crushed stone aggregate; and any other similar, incidental, or appurtenant operation that may be necessary to properly complete the Work.

B. The **Contractor** shall provide all services, labor, materials, and equipment required for all installation of crushed stone aggregate and related operations necessary or convenient to the **Contractor** for furnishing complete Work as shown on the Plans or specified in these Contract Documents.

C. Related Work Specified Elsewhere:

1. Section 01210 - Measurement and Payment
2. Section 02200 - Earthwork
3. Section 02324 - Trenching and Trench Backfilling
4. Section 02920 - Site Restoration
5. Section 03300 - Cast-In-Place Concrete

1.02 SUBMITTALS

Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300.

1.03 QUALITY ASSURANCE

A. Reference Standards: The **Contractor** shall comply with the applicable provisions and recommendations of the latest editions of the following standards, except as otherwise shown on the Plans or specified in these specifications.

1. AASHTO M147 - 65 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in) Drop.
3. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
4. ASTM D698 – 00a - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3; 600 kN-m/m3).
5. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soils Using Modified Effort (56,000 ft-lbf/ft3; 2,700 kN-m/m3).
6. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

7. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Coarse aggregate shall be crushed stone of a quality equal to the best Stone Mountain Granite, of solid composition, free from dirt and adherent coatings, and suited for the class of its intended usage.

B. Unless otherwise specified elsewhere in these Specifications or directed by the **County**, gradation of coarse aggregate shall conform to size Number 467, Number 57, or Number 67 as described in ASTM C33.

C. The nominal maximum size of coarse aggregate used in concrete shall not be larger than one-fifth (1/5) of the narrowest dimension between sides of the forms, one-third (1/3) of the depth of slabs, or three-fourths (3/4) of the minimum clear spacing between reinforcing bars as described in ACI 68-50.

D. Sand shall be clean and sharp, free from all deleterious substances, and shall conform to the requirements of ASTM C33.

PART 3 - EXECUTION

3.01 EXAMINATION

The **Contractor** shall verify that subgrade has been inspected and that gradients and elevations are correct and dry.

3.02 AGGREGATE PLACEMENT

A. The **Contractor** shall place coarse aggregates in areas shown on the Plans or directed by the **County**.

B. The **Contractor** shall place and compact coarse aggregate in accordance with the requirements of Section 02200 - Earthwork and Section 02324 - Trenching and Trench Backfilling.

C. The **Contractor** shall level and contour surfaces to elevations and gradients indicated on the Plans.

D. The **Contractor** shall add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

E. The **Contractor** shall add water to assist compaction. If excess water is apparent, the **Contractor** shall remove aggregate and aerate to reduce moisture content.

F. The **Contractor** shall use mechanical vibrating tamping in areas inaccessible to compaction equipment.

3.03 TOLERANCES

A. Flatness: Maximum variation of one-quarter (¼) inch measured with a ten (10) foot metal straight edge.

B. Scheduled Compacted Thickness: Within one-quarter (¼) inch.

C. Variation from True Elevation: Within one-half (½) inch.

D. Base: Compacted to ninety-five (95) percent modified proctor density as determined by ASTM D1557.

+++ END OF SECTION 02060 +++

SECTION 02110
CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 SCOPE

A. Work described in this Section includes furnishing all labor, materials, equipment, tools, and incidentals required for all clearing and grubbing including, but not limited to, the removal from the Site of trees, stumps, roots, brush, structures, abandoned utilities, trash, debris, and all other materials found on or near the surface of the ground in the construction area and understood by generally accepted engineering practice not to be suitable for construction of the type contemplated.

B. The extent of route clearing is that minimum degree of clearing necessary to carry out all construction activities, including construction of appurtenances and other additional clearing needed for access purposes. The route clearing shall not exceed the easement, temporary easement, or the signed right of entry agreement.

C. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion control requirements.

D. Clearing operations include, but are not limited to, the following:

1. Protection of existing trees and other vegetation,
2. Removal of trees and other vegetation,
3. Clearing,
4. Removing above-grade improvements,
5. Removing underground improvements,
6. Restoring damaged improvements,
7. Protecting above-grade and underground improvements,
8. Erosion control of disturbed areas.

E. Related Work Specified Elsewhere:

1. Division 1, General Requirements.
2. Section 02125, Temporary and Permanent Erosion and Sediment Control
3. Section 02050, Demolition
4. Section 02200, Earthwork

1.02 JOB CONDITIONS

A. Protection of Existing Improvements:

1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements.

2. Protect improvements on adjoining properties as well as those on the

project site. Restore existing improvements damaged by this work to their original condition, as acceptable to the **County** or property owner, as required. Replace property line monuments (such as iron pins) removed or disturbed by clearing operations under the direction of a Land Surveyor licensed in the State of Georgia. A submittal is required with data showing the survey and sealed by the licensed land surveyor.

B. Protection of Existing Trees and Vegetation:

1. Protect existing trees and other vegetation to avoid cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip lines, foot or vehicular traffic, and parking of vehicles or equipment within drip line. Provide temporary fences, barricades, or guards as required to protect trees and vegetation that shall be left standing.

2. Provide protection for tree roots over one and one-half (1-1/2) inches in diameter that are cut during any construction operation. Coat the cut faces with emulsified asphalt or other acceptable coating that has been specially formulated for horticultural use on cut or damaged plant tissues. Temporarily cover all exposed tree roots with wet burlap to prevent roots from drying out; provide earth cover as soon as possible.

3. Repair or replace damaged trees and vegetation resulting from any construction operation in a manner acceptable to the **County**. A qualified arborist approved by the **County** shall perform tree damage repair at no cost to the **County**. Replace damaged trees that cannot be repaired and restored to full-growth status, as determined by the **County**.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXISTING TREES AND VEGETATION

Avoid cutting or injuring trees and vegetation outside easement line and outside areas to be cleared. The **Contractor** shall be responsible for damages outside these lines.

3.02 CLEARING AND GRUBBING

A. Clearing operations shall begin no more than seven (7) days before beginning construction work for any area.

B. Materials to be cleared, grubbed and removed from the project site include but are not limited to vegetation, trees, stumps, roots, lawns, shrubbery, gardens, paving, miscellaneous structures, debris, and abandoned utilities to the minimum practicable extent to complete the work. Limit clearing to a single lane work route without provision for construction vehicles to pass utility operation. Determine and stake limitations of construction easement or right-of-way prior to commencement of work and keep construction activity within such limits.

C. Grubbing shall consist of completely removing roots, stumps, trash, and other debris from all areas to be graded so that topsoil is free of roots and debris. Topsoil is to be left sufficiently clean so that further picking and raking shall not be required.

D. All stumps, roots, foundations, and planking embedded in the ground shall be removed and disposed of. Stumps and roots larger than one (1) inch shall be grubbed and removed to a depth not less than four (4) feet below grade. All holes or cavities that extend below the subgrade elevation of the proposed work shall be filled with crushed rock or other suitable material, compacted to the same density as the surrounding material. Piling and butts of utility poles shall be removed to a minimum depth of two (2) feet below the limits of excavation for structures, trenches and roadway subgrade or two (2) feet below finish grade, whichever is lower.

E. Landscaping features shall include, but are not necessarily limited to: fences, cultivated trees, cultivated shrubbery, property corners, man made improvements, subdivision, and other signs shall be moved off the easement. The **Contractor** shall take extreme care in moving landscape features and shall reestablish these features as directed by the **County.**

F. Surface rocks and boulders shall be grubbed from the soil and removed from the site or used as fill in accordance with Section 02200 - Earthwork.

G. Where the tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility.

H. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.

I. All fences adjoining any excavation or embankment that, in the **Contractor's** opinion, may be damaged or buried, shall be carefully removed, stored, and replaced. Any fencing that is damaged shall be replaced with new fence material of equal or better quality and construction. The **Contractor** shall be responsible for the new fence material cost if the **County** deems the **Contractor** was negligent.

J. Stumps and roots shall be grubbed and removed to a depth not less than two feet below grade. All holes or cavities that extend below the subgrade elevation of the proposed work shall be filled with crushed rock or other suitable material, compacted to the same density as the surrounding material

K. Burying or burning of residual materials and organics shall not be allowed.

L. The **Contractor** shall utilize special precautions required for the protection and preservation of trees, cultivated shrubs, sod, fences, etc. situated within the construction area but not directly within excavation and/or fill limits. The **Contractor** shall be responsible for repair or replacement of any items damaged as a result of its operations.

M. Remove lawn sod by cutting into maximum size that can be handled without tearing, stripping sod and underlying topsoil, and stockpiling for use in restoring the surface area. Water sod and otherwise maintain sod in viable, growing condition. Alternative means of lawn sod replacement may be approved by the **County**.

N. Remove above-grade structures only where shown on the Drawings or as authorized by the **County**.

3.02 HOLES AND DEPRESSIONS

A. Fill holes, depressions, and voids created or exposed by clearing operations with non-organic soil material approved by the **County**, unless further excavation or earthwork is indicated.

B. Place fill material in horizontal layers not exceeding six (6) inches loose-depth and compact to a ninety-five (95) percent standard Proctor.

3.03 DISPOSAL OF WASTE MATERIALS

A. Disposal General Requirements: Dispose cleared matter daily so as to maintain site in a safe and neat condition throughout the contract period. Owners of the property may remove merchantable timber, buildings, or other items from the work site before the **Contractor** begins operations, and no assurance exists that any such material will be on the work site when the **Contractor** begins work.

B. On-Site Disposal:

1. When authorized by the **County**, cut tree trunks and limbs, over two inches in diameter, into forty-eight- (48-)inch lengths and neatly stack within work limits on the same property as that on which the tree originally grew.

2. On undeveloped property, distribute brush, trees, and limbs less than two inches in diameter, within the work area from which cut, as directed by the **County**. On developed property, remove all such clearing waste and properly dispose of it off-site.

C. The debris resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the **Contractor** and shall be disposed of in accordance with all requirements of federal, state, **County** and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any private property except with written consent of the property owner. In no case shall any material or debris be left on the project site, shoved onto abutting private properties, or buried on the project site.

3.04 CONSTRUCTION ACCESS ROUTE ON EASEMENT

A. When shown on the Drawings or directed by the **County**, a construction access route shall be built on the sewer easement for the purpose of accessing manholes and performing all other necessary work within the easement.

B. The Construction access route shall be cut (10) ten feet wide, minimum, and (6) six inches deep below existing grade. Filter fabric shall be placed at the bottom of the cut, and surge stone shall be placed on top of the fabric, filling the six- (6-) inch depth along the roadway.

C. The filter fabric for use under the stone shall be as specified in Section 02125.

D. Surge stone shall be 4” to 6” size (4X6) rip rap type stone, or equivalent. Use sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces shall not be acceptable. Specific gravity shall be two (2.0) or greater. Stones shall have less than sixty-six (66) percent wear when tested in accordance with AASHTO T-96.

3.06 TREE REMOVAL ON EASEMENTS

A. The **Contractor** shall confirm ownership of all on-site trees within the easement before work commences and submit a tree removal and disposal plan to the **County**.

B. The **County**’s written approval shall be obtained prior to the removal of any trees from the easement.

C. All trees that need further processing (wood chips) on-site or disposal off-site shall be processed or disposed of in conformance with Federal, State, and local rules and regulations.

D. The **Contractor** shall acquire any additional permits prior to commencement of any type of work done in the easement

E. Stemmed vegetation, such as brush, shrubs, and trees shall be removed at or near the ground level, leaving the root systems intact.

F. Trees shall be felled into the cleared construction area or areas to be cleared and not onto vegetation that shall be preserved.

G. Trees that have fallen into water bodies, or beyond the construction area, shall be removed immediately. All damage and remediation costs shall be the **Contractor’s** responsibility.

+++ END OF SECTION 02110 +++

SECTION 02112
ROUTE CLEARING

PART 1 – GENERAL

1.01 SCOPE

A. The extent of route clearing is that minimum degree of clearing necessary to carry out construction activities such as pipe bursting, pipe repairs and other pipeline renewal processes including construction of appurtenances, as well as other additional clearing needed for access purposes. The route clearing shall not exceed the easement, temporary easement or the signed right of entry agreement.

B. The **Contractor** shall endeavor to minimize disruption to the neighborhood and shall adjust route-clearing plans to avoid important landscaping features where practicable.

C. Route clearing operations include, but are not limited to, the following:

1. Protecting existing trees and other vegetation
2. Removing trees and other vegetation
3. Clearing
4. Removing above-grade improvements
5. Removing underground improvements
6. Restoring damaged improvements
7. Protecting above-grade and underground improvements
8. Controlling erosion in disturbed areas

1.02 QUALITY ASSURANCE

A. The **Contractor** shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state, or federal authorities having jurisdiction over the Project. The **Contractor** shall obtain all required permits of a temporary nature for construction operations.

B. Burning of cleared or any other materials on site is not permitted. The **Contractor** shall remove material arising from any necessary clearing and grubbing.

1.03 JOB CONDITIONS

A. Protection of Existing Improvements:

1. Provide barricades, coverings, or other types of protection necessary to prevent unnecessary damage to existing improvements.

2. Protect improvements on adjoining properties as well as those on the project site. Restore improvements damaged by this work to their original condition, as acceptable to the Owners or other parties or authorities having jurisdiction. Replace property line monuments (such as iron pins) removed or disturbed by clearing operations. This work shall be performed by a Land Surveyor licensed in the State of Georgia. A submittal is required with data showing the survey and sealed by the licensed land surveyor.

B. Protection of Existing Trees and Vegetation:

1. Protect existing trees and other vegetation against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip lines, excess foot or vehicular traffic, or parking of vehicles or equipment within drip line. Provide temporary fences, barricades, or guards as required to protect trees and vegetation to be left standing.

2. Provide protection for tree roots over 1-1/2 inches in diameter that are cut during any construction operation. Coat the cut faces with emulsified asphalt, or other acceptable coating, especially formulated for horticultural use on cut or damaged plant tissues. Temporarily cover all exposed roots of trees with wet burlap to prevent roots from drying out; provide earth cover as soon as possible.

3. Repair or replace unnecessarily damaged trees and vegetation, as determined by the **County**, resulting from any construction operation, in a manner acceptable to the property owner and the **County** at the **Contractor's** expense. A qualified arborist shall perform tree damage repair. Replace unnecessarily damaged trees that cannot be repaired and restored to full-growth status, as determined by the arborist.

C. Protection of Adjacent Property:

1. Protect improvements, trees and vegetation on adjoining property as well as those on property requiring route-clearing work.

2. Execute work so as not to create a nuisance to any person including persons utilizing adjacent property.

3. Use work methods and provide temporary facilities as necessary to prevent washing, erosion, siltation or dust damage, or hazard to persons and property, within and off the work area.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. The **Contractor** shall furnish equipment of the type normally used in clearing and grubbing operations including, but not limited to, tractors, trucks, loaders, mowers, and clippers.

PART 3 – EXECUTION

3.01 CLEARING

A. Route clearing operations shall begin no more than seven days before beginning construction work for any area.

B. Materials to be cleared, grubbed and removed from the project site include but are not limited to vegetation, trees, stumps, roots, lawns, shrubbery, gardens, paving, miscellaneous structures, debris, and abandoned utilities to the minimum practicable extent to complete the work. Limit clearing to a single lane work route without provision for construction vehicles to pass utility operation. Accurately determine limitations of the construction easement or right-of-way, and keep construction activity within such limits.

C. Grubbing shall consist of completely removing roots, stumps, trash and other debris from all graded areas so that topsoil is free of roots and debris. Topsoil is to be left sufficiently clean so that further picking and raking shall not be required.

D. All stumps, roots, foundations, and planking embedded in the ground shall be removed and disposed of. Piling and butts of utility poles shall be removed to a minimum depth of two feet below the limits of excavation for structures, trenches and roadways or two feet below finish grade, whichever is lower.

E. Landscaping features shall include, but are not necessarily limited to: fences, cultivated trees, and cultivated shrubbery. Property corners, man-made improvements, and subdivision and other signs shall be moved off the easement. The **Contractor** shall take extreme care in moving landscape features and shall reestablish these features as directed by the **County**.

F. Surface rocks and boulders shall be grubbed from the soil and removed from the site if not suitable as riprap.

G. Where the tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility.

H. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.

I. All fences adjoining any excavation or embankment that, in the **Contractor's** opinion, may be damaged or buried, shall be carefully removed, stored, and replaced. Any fencing that, in the **County's** opinion, is significantly damaged shall be replaced with new fence material of equal or better quality and construction. The **Contractor** shall be responsible for the cost of the new fence material if the **County** deems the **Contractor** was negligent.

J. Stumps and roots shall be grubbed and removed to a depth not less than two feet below grade. All holes or cavities that extend below the subgrade elevation of the proposed work shall be filled with crushed rock or other suitable material, compacted to the same density as the surrounding material.

K. The **Contractor** shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, etc. situated within the limits of any temporary easements, but not directly within the permanent easements. The **Contractor** shall be held liable for any damage the **Contractor's** operations have inflicted on such property.

L. The **Contractor** shall be responsible for all damages to existing improvements outside the permanent easement resulting from **Contractor's** operations.

M. Remove lawn sod by cutting into the maximum size that can be handled without tearing or stripping sod and the underlying topsoil. Store it for use in restoring the surface area. Water the sod and otherwise maintain it in viable, growing condition. Alternative means of lawn sod replacement may be considered by the **County**.

N. Remove above-grade structures only where specifically authorized.

O. Remove conflicting fences and provide effective, temporary measures to prevent domestic animals from wandering to other lands. Reconstruct fences promptly.

P. Remove abandoned underground facilities such as utilities and structures, walls, footings, basements, wells, septic tanks, cisterns, underground pipe, and other items that conflict with construction.

3.02 HOLES AND DEPRESSIONS

A. Fill holes, depressions, and voids created or exposed by clearing operations with non-organic soil material, unless further excavation or earthwork is indicated.

B. Place fill material in horizontal layers not exceeding six (6) inches loose-depth and thoroughly compact to a density at least equal to the adjacent original ground.

3.03 DISPOSAL OF WASTE MATERIALS

A. Disposal General Requirements: Accomplish disposal of cleared matter daily so as to maintain site in a safe and neat condition throughout the contract period. Owners of the property may remove merchantable timber, buildings, or other items of value from the work site before the **Contractor** begins operations, and no assurance exists that any such material shall be on the work site when the **Contractor** begins work.

B. On-Site Disposal:

1. Unless a property owner requests complete removal, cut tree trunks and limbs, over two inches in diameter, into forty-eight (48) inch lengths and neatly stack within work limits having the same property ownership as that on which the tree originally grew.

2. On undeveloped property, distribute brush, trees and limbs less than two inches in diameter, within the work area from which cut, in such a way as not to be objectionable to the property owner. On developed property, remove all such clearing waste and properly dispose of it off-site.

3.04 DISPOSAL OF DEBRIS

The debris resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the **Contractor** and shall be disposed of in accordance with all requirements of federal, state, **County** and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any private property except with written consent of the property owner with an approved permit from the **County**. In no case shall any material or debris of any kind be left on the Project, shoved onto abutting private properties, or buried on the Project.

3.05 CONSTRUCTION ACCESS ROUTE ON EASEMENT

A. When directed by the **County**, a construction access route shall be built on the sewer easement for the purpose of accessing manholes and performing all other necessary work within the easement.

B. Construction access route shall be cut a minimum of ten (10) feet wide, and six inches (6) deep below existing grade. Filter fabric shall be placed at the bottom of the cut, and surge stone shall be placed on top of the fabric, filling the six (6) inch depth along the roadway.

C. The filter fabric for use under the stone shall be as specified in Section 02125.

D. Surge stone shall be four to six (4” to 6”) inch size riprap type stone, or equivalent. The **Contractor** shall use sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces shall not be acceptable. Specific gravity shall be two (2.0) or greater. Stones shall have less than sixty-six (66) percent wear when tested in accordance with AASHTO T-96.

3.06 TREE REMOVAL ON EASEMENTS

A. The **Contractor** shall confirm ownership of all on-site trees within the easement before work commences and submit a tree removal plan to the **County**.

B. The **County’s** approval shall be obtained prior to the removal of any trees from the easement such concurrence shall be obtained in writing.

C. The approval of the **County** concerning the method and location of disposal of materials shall be obtained before work commences.

D. All trees that need further processing (wood chips) on-site or disposal off-site shall be processed or disposed of in conformance with Federal, State, and local rules and regulations.

E. **Contractor** shall ensure all utilities are located prior to the commencement of any clearing or construction work in the easement.

F. **Contractor** shall acquire any necessary permits prior to commencement of any type of work done in the easement especially for the removal of trees and crossing of waterways.

G. Stemmed vegetation such as brush, shrubs, and trees as necessary shall be removed at or near the ground level, leaving the root systems intact.

H. Trees shall be felled into the cleared construction area or areas to be cleared and not onto vegetation to be preserved.

I. Trees that have fallen into water bodies, or beyond the construction area, shall be removed immediately. All damage and remediation costs shall be the **Contractor's** expense.

+++ END OF SECTION 02112 +++

SECTION 02125
TEMPORARY AND PERMANENT EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This section includes requirements for the provision, maintenance, and subsequent removal of temporary and/or permanent erosion and sediment controls as shown on the approved plans.

B. The temporary erosion and sediment controls specified herein shall be coordinated with the permanent erosion controls, to assure economical, effective, and continuous erosion and sediment control during construction within acceptable limits. Acceptable limits are as established by the Georgia Erosion and Sedimentation Control Act of 1975, as amended, Section 402 of the Federal Clean Water Act, and applicable codes, ordinances, rules, regulations, and laws of local and municipal authorities having jurisdiction.

C. Land disturbance activities shall not commence until the Land Disturbance Permit Stream Buffer variance, and Notice of Intent, if applicable, have been properly issued and all required meetings have taken place.

D. This section requires the **Contractor** to design project specific devices and practices to meet requirements of the related work and references listed below in conjunction with the **Contractor's** own means, methods, and techniques, schedules and sequences of work, and actual conditions encountered. Design shall be performed by professionals experienced and familiar with storm water and drainage characteristics as well as the requirements of references listed below.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Erosion and Sediment Control Plan
B. Section 02485 - Seeding
C. Section 02486 - Sodding
D. Section 02490 - Trees, Shrubs, and Ground Cover
E. Section 02750 - Bypass Pumping

1.03 REFERENCES

A. DeKalb **County** Soil Erosion and Sedimentation Control Ordinance.
B. DeKalb **County** Comprehensive Stormwater Management and Stormwater Quality Ordinance.
C. Manual for Erosion and Sediment Control in Georgia, as published by the Georgia Soil and Water Conservation Commission (current edition).
D. Federal Clean Water Act.
E. Georgia Erosion and Sedimentation Act of 1975, as amended.
F. Georgia Department of Natural Resources, Environmental Protection Division General NPDES Permit # 100002.

1.04 QUALITY ASSURANCE

The **Contractor** shall provide at least one (1) representative involved in the project's land disturbing activities that has successfully completed the erosion and sediment control education and certification program as administered by the Georgia Soil and Water Conservation Commission; this "certified person" shall have completed as a minimum, the Level 1A (Fundamentals) course. A "certified person" shall be present onsite **at all times** when work is being performed. Failure to maintain a certified person onsite at all times shall result in a stop work order or other appropriate enforcement action.

1.05 SUBMITTALS

A. Within fifteen (15) days after the date of the Notice to Proceed, the **Contractor** shall submit a narrative description, working drawings and schedule for proposed temporary erosion and sedimentation controls to the **County** for approval. The description and working drawings shall meet the requirements of the Georgia Erosion and Sedimentation Act of 1975 (as amended) and local soil erosion and sedimentation control ordinances. All fines imposed for improper erosion and sedimentation control shall be paid by the **Contractor**.

B. Land disturbance activity shall not commence until the erosion and sedimentation control plans are approved. The **County** may provide a reproducible drawing of plan sheets to the **Contractor** for **Contractor's** use if necessary. The reproducible drawing shall not bear the Design Engineer's seal or logo and is provided only for the **Contractor's** convenience in obtaining land disturbance permits.

C. The description and working drawings shall indicate controls that shall minimize erosion and prevent the off-site transport of sediment in storm water and drainage from the jobsite areas.

D. Submit a written plan to the **County** for both temporary and permanent grassing. The plan shall include selection of species, dates, and rates of application for seeding, fertilizer, and mulching.

E. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300 of these Specifications. Unless otherwise noted, all submittals shall be produced at the Pre-Construction Meeting. In addition, the following information shall be submitted to the **County**:

   i. Certification credentials of all persons that have completed the Georgia Soil and Water Conservation Commission's erosion and sediment control education and certification program and that will be involved in the project shall be provided to the **County** prior to the start of any land disturbing activities.

PART 2 – PRACTICES AND PRODUCTS

2.01 GENERAL

A. The following paragraphs generally describe the erosion and sediment control practices and products typically employed on a utility construction project. The detailed requirements for these, as well as for other measures which may be needed to achieve effective erosion control, shall be as specified in the Standards and Specifications for General Land Disturbing Activities of the Manual for Erosion and Sediment Control in Georgia.

B. The paragraph titles and alphanumeric codes refer to specific structural and vegetative type practices included in the aforementioned Standards. All practices shall be considered as temporary erosion and sediment control features, except the channel stabilization, gabions and grassing/sodding, trees, shrubs, and groundcovers, which are considered as permanent measures.

2.02 STRUCTURAL PRACTICES

A. CONSTRUCTION EXIT - Co

1. A construction exit consists of a stone-stabilized pad with a geotextile underliner located at any point where traffic shall be leaving a construction site to a public right-of-way, street, alley, sidewalk, or parking area.

2. Construction exits are used to reduce or eliminate transport of mud from the construction area.

3. Construction exits shall consist of graded one and one-half to three and one-half (1.5 to 3.5) inch stone meeting National Stone Association grade R-2. The geotextile underliner shall be a non-woven fabric equal to No. C-45NW as manufactured by Contech Construction Products, Inc. or approved equal.

B. CHANNEL STABILIZATION (RIPRAP) - Ch

1. Channel stabilization consists of structures to stabilize an open channel for water conveyance. Such stabilization is typically applied in those locations where the channel banks and bed have been disturbed by excavation for a pipeline crossing.

2. Channels shall be stabilized using a rock riprap lining. The lining shall consist of filter bedding stone and graded riprap stone. Sizes of stone shall be as classified by either the National Stone Association (N.S.A.) or the Department of Transportation (D.O.T.). Riprap stone shall be equal to Georgia Department of Transportation Type 1 or Type 3. Filter bedding stone shall be graded stone not exceeding six (6) inches in diameter. An appropriate geotextile fabric may be substituted for filter stone with **County** approval.

C. GABIONS – Ga

Gabions are large, multi-celled mesh boxes used in channel revetments, retaining walls, abutments, check dams, etc. Boxes shall be constructed of PVC coated wire mesh and filled with four to eight (4" to 8") inch pieces of durable stone. Stone placement shall be principally by hand or gentle mechanical dumping in no more than twelve (12) inch layers with PVC coated wire cross and diagonal supports in each cell to retain and support basket sides at those intervals. Minimum size for box gabions shall be 6'-0" x 3'-0" x 3'-0". Minimum size for Reno Mattresses shall be 9'-9" x 6'-6" x 0'-9". Gabions shall be manufactured by Maccaferri, USA or approved equal.

D. TEMPORARY STREAM CROSSING - Sr

1. A temporary stream crossing is a structure installed across a flowing stream for use by construction equipment.

2. Structures may include bridges, round pipes, and pipe arches. The structure shall be large enough to convey the full bank flow of the stream and be designed by the **Contractor** to withstand flows from a two (2) year, twenty-four (24) hour frequency storm.

E. CHECK DAMS - Cd

1. Check dams are barriers composed of stone or hay bales placed across a natural or constructed drainage way to prevent erosion in areas of concentrated flows.

2. Stone check dams shall not be utilized where the drainage area exceeds five acres. Hay bale check dams shall not be used where drainage areas exceed two (2) acres. Check dams shall not be installed in live streams.

3. Stone check dams shall be constructed of graded size two to ten (2 to 10) inch stone.

F. SEDIMENT BARRIER

1. STAKED HAYBALES - Sd1

Hay bale barriers are placed in a single row on natural ground where the most likely erodible areas are located to restrain sediment particles carried by sheet flow.

2. SILT FENCE - Sd1

a. Silt fences are temporary measures to retain suspended silt particles carried by sheet flow.

b. Silt fence consists of silt fabric, as specified in the Georgia Department of Transportation list #36, wood or steel posts, and wire or nail fasteners.

c. Type A silt fence is a non-woven thirty-six (36) inch wide filter fabric and shall be used on developments where the life of the project is greater than or equal to six (6) months. The flow rate (gallon/minute/square foot) is twenty-fine (25). Additionally, Type A fabric has a color mark.

d. Type C silt fence is a woven thirty-six (36) inch wide filter fabric with wire reinforcement. The wire reinforcement is necessary because this fabric allows almost three times the flow rate as Type A silt fence. The flow rate (gallon/minute/square foot) is seventy (70). Additionally, Type C fabric does not have a color mark.

G. INLET SEDIMENT TRAP - Sd2

1. Inlet sediment traps are temporarily protective devices formed around a storm drain inlet to trap sediment.

2. Inlet sediment traps are used to prevent sediment from leaving a site or from entering storm drain systems prior to permanent stabilization of the disturbed area.

H. ROCK FILTER DAM - Rd

1. Rock filter dams are installed across small non-actively flowing drainageways and are applicable for projects that involve grading activity directly in those drainageways.

2. Rock filter dams consist of riprap faced with smaller rock on the upstream side for additional filtering affect.

I. STREAM DIVERSION - PIPED DIVERSION (DV1), PUMPED DIVERSION (DV2), ENGINEERED DIVERSION STRUCTURES (DV3))

1. Installation of water and sewer pipelines designed to cross natural streams shall be accomplished only in “dry channel” conditions (i.e. in the absence of stream flow in the work area). Provisions shall be implemented to divert a constant quantity and quality of stream waters around the construction area by means of adequately sized pipes, pumps, or engineered diversion structures or other methods proposed by the **Contractor** and approved by the **County**. These diversion devices shall be maintained throughout the duration of construction within the stream channel. The structures shall be designed by professionals familiar with storm water / drainage characteristics and applicable requirements to withstand flows from a two (2) year, twenty-four (24) hour frequency storm event unless otherwise noted on the drawings. Stream diversion devices shall not be removed until all disturbed areas of the stream channel bottom and banks are returned to original contours and stabilized to prevent erosion. The planning, scheduling, and sequencing of work by the **Contractor** shall be described in a detailed submittal to the **County** for approval. The final implementation schedule shall only be

determined in conjunction with forecasted weather conditions for the period anticipated for diversion.

a. Piped Diversion - Dv1
Piped diversions shall be installed and implemented in conjunction with and as an extension of Temporary Stream Crossings - (Sr). Pipes shall be sized as shown on the drawings with sufficient coordination and planning as to their locations, elevations, etc. to allow subsequent water/sewer pipeline construction to occur in "dry channel' conditions.

Necessary sandbags or other sealing devices, dewatering, etc. shall be provided to accomplish this piped diversion as well as other "Best Management Practices" to ensure that erosion and sedimentation is controlled.

b. Pumped Diversion - Dv2
Pumped diversions shall be installed and implemented in conjunction with and as an extension of Temporary Stream Crossings (Sr). Pumps and piping shall be sized as shown on the drawings with sufficient coordination and planning as to their locations, elevations, etc. to allow subsequent water/sewer pipeline construction to occur in "dry channel" conditions.

Necessary sandbags or other sealing devices, dewatering, discharge sediment basins, sediment filter socks, "floc logs," "dirt bags," etc. shall be provided to accomplish this pumped diversion as well as other "Best Management Practices" to ensure that erosion and sedimentation is controlled.

c. Engineered Diversion Structure - Dv3
Engineered diversion structures such as "Aqua Barrier" by Nilex, Inc., "Portadam" by Portadam Inc, interlocked sheet piling, riprap cofferdams, etc. shall be installed and implemented to allow subsequent water/sewer pipeline construction to occur in "dry channel" conditions. Sequential work elements may be involved to allow the construction area to progress across a stream, and ensuring that the previously completed segment is reasonably restored and stabilized.

Necessary sandbags, geotextiles, linings, or other sealing devices, dewatering, etc, shall be provided to accomplish this manner of diversion as well as other "Best Management Practices" to ensure that erosion and sedimentation is controlled.

2.03 - VEGETATIVE PRACTICES

A. GENERAL

1. Disturbed areas shall be stabilized as construction progresses. For sanitary

sewers or water mains installed within easements, the construction corridor shall not exceed one thousand (1,000) linear feet without stabilization. All other projects shall not exceed three hundred (300) linear feet without stabilization

B. DISTURBED AREA STABILIZATION (WITH MULCHING ONLY) - Ds1

1. This practice is applicable where disturbed areas, temporarily idle, have not been established to final grade and/or where permanent vegetative cover is delayed for a period not to exceed six (6) months.

2. Mulch materials shall consist of dry straw or hay, wood chips, erosion control matting or netting, or polyethylene film. The mulch shall be uniform, spread over the designated area from two to four (2 to 4) inches thick.

3. Any and all disturbed areas that have not yet reached final grade shall be stabilized with mulch or temporary grassing within fourteen (14) calendar days of disturbance.

C. DISTURBED AREA STABILIZATION (WITH TEMPORARY SEEDING) - Ds2

1. Temporary seeding is a measure consisting of seeding and mulching to reduce erosion. All disturbed areas shall be seeded when and where necessary to reduce erosion.

2. This practice is applicable where disturbed areas, temporarily idle, have not been established to final grade and/or where permanent vegetative cover is delayed for up to six (6) months.

3. Temporary seeding consists of a grass or grass-legume mixture suitable to the area and season of the year.

D. DISTURBED AREA STABILIZATION (WITH PERMANENT VEGETATION) - Ds3

See Section 02485 – Seeding
See Section 02486 – Sodding
See Section 02490 – Trees, Shrubs, and Ground Cover

1. Permanent (perennial) vegetation shall consist of planted grasses, trees, shrubs, and/or perennial vines; a crop of perennial vegetation appropriate for the time of year and region (or to match, in kind, pre-existing maintained vegetation); or a crop of annual vegetation and seeding of target crop perennials appropriate for the region (or to match, in kind, pre-existing maintained vegetation), such that within the growing season a seventy (70) percent coverage by perennial vegetation shall be achieved.

2. This practice is applicable on disturbed areas at final grade.

3. Permanent perennial vegetation shall be applied on rough graded areas that shall be undisturbed for more than (6) months.

E. DISTURBED AREA STABILIZATION (WITH SODDING) - Ds4

See Section 02485 – Seeding
See Section 02486 – Sodding

1. This practice shall consist of ground preparation, furnishing lime and fertilizer and placement of sod.

2. Sod shall be from local area and delivered to the job site in either industry standard blocks or rolls. Sod shall not be delivered to the job site more than twenty-four (24) hours prior to installation. Sod shall be hand placed with edges butted and cut as required to fit the placement area. The finished installation shall be rolled with a lawn roller and thoroughly watered. The sod shall be watered daily for the first five days after installation.

3. Sod shall be anchored on slopes steeper than three to one (3:1).

F. EROSION CONTROL MATTING AND BLANKETS - Mb

1. This practice is a protective covering (blanket) or soil stabilization mat used to stabilize disturbed areas until permanent vegetation on steep slopes, channels, or shorelines can be established.

2. Concentrated flow areas, all slopes steeper than two and one-half to one (2.5:1) and with a height of ten (10) feet or greater, and cuts and fills within stream buffers, shall be stabilized with the appropriate erosion control matting or blankets.

3. All blanket and matting materials shall be on the Georgia Department of Transportation Qualified Products List (QPL #62 for Blankets, QPL #49 for Matting).

G. JOINT PLANTING STABILIZATION (rip-rap and willow stakes)
Joint planting is a system that installs live willow stakes between rip-rap (type 3) placed previously along the stream bank. It is installed to increase the effectiveness of the rock system by forming a living root matt in the base upon which rock has been placed and improve the environmental function and aesthetics of the rock bank. The rock shall be principally placed by hand or gentle mechanical dumping. Willow stake density of installation shall be 3 to 5 cuttings per square yard. Cuttings shall be two (2) inches in diameter and three and one–half (3.5) feet in length. The cutting shall be freshly cut and alive. Two thirds (2/3) of live stake shall be in the ground below the previously placed rock. Only native species willow stakes shall be used.

PART 3 - EXECUTION

3.01 GENERAL

A. At the Preconstruction Conference, the **Contractor** shall submit a schedule for accomplishing the temporary erosion control work for specific conditions to be encountered on the project.

B. The **Contractor** shall install all erosion and sediment control devices as required by actual field conditions, as shown on the approved plans, or as directed by the **County** or by any agency having jurisdiction in the locale of the project.

C. The erosion and sediment control devices shall be installed by the **Contractor** before land disturbing activities begin.

D. The **County** has the authority to direct the **Contractor** to provide immediate, additional temporary erosion control measures to prevent contamination of adjacent waterways and drainage ways. Additional erosion control measures may be used to correct conditions that develop during construction that were not foreseen during the design stage or that are needed prior to installation of the permanent erosion control features.

E. The **County** may limit the area of excavation in progress based on the **Contractor's** capability and progress in keeping the finish grading, mulching, and seeding current, in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures, such as mulching or temporary seeding, shall be taken immediately to the extent feasible and justified.

F. The **Contractor** shall incorporate all permanent erosion control features (grassing and sodding) into the project at the earliest practicable time.

3.02 INSTALLATION

A. Erosion control measures shall be designed by professionals familiar with storm water / drainage characteristics, installed, and maintained in accordance with the "Manual for Erosion and Sediment Control in Georgia" published by the Georgia Soil and Water Conservation Commission.

3.03 INSPECTION

A. Upon completion of installation, the **County** shall inspect the erosion and sediment control devices for proper installation, flaws, defects, or other damage. The **Contractor** shall repair or replace, at its expense, the unacceptable portions as directed by the **County.**

B. All erosion and sediment control devices shall be inspected by the **Contractor** at least weekly and after each rainfall occurrence.

C. All projects that require compliance with General NPDES Permit 100002 guidelines shall have inspections and monitoring in accordance with the specific Comprehensive Monitoring Plan.

3.04 MAINTENANCE

A. The **Contractor** shall maintain the erosion and sediment control devices until the project is completed and all disturbed areas are stabilized. Maintenance of the devices shall include: removal and disposal of silt accumulation; replacement of damaged or deteriorated devices; other repairs; and the installation of additional devices should those devices installed prove to be inadequate. The **Contractor** shall provide this maintenance at no additional cost to the **County**.

Silt shall be cleaned out once it has accumulated to half the height of the device or when half of the available sediment storage capacity has been attained.

3.05 REMOVAL

A. Temporary erosion and sediment devices shall remain in place until such time as a satisfactory stand of grass has been established, unless the **County** or local government authority directs earlier removal. Damaged or otherwise unusable devices shall be removed from the site and disposed of properly.

B. After erosion and sediment device removal, the **Contractor** shall dress out any disturbed areas in the vicinity of the removed device and grass according to these Specifications.

+++ END OF SECTION 02270 +++

SECTION 02140
DEWATERING

PART 1 - GENERAL

1.01 SCOPE

A. Construct all permanent Work in areas free from water. Design, construct, and maintain all dikes, levees, cofferdams, diversion, and drainage channels as necessary to maintain the areas free from water and to protect the areas to be occupied by permanent work from water damage. Remove temporary works after they have served their purpose.

B. The **Contractor** shall be responsible for the stability of all temporary and permanent slopes, grades, foundations, materials, and structures during the course of the Contract. Repair and replace all slopes, grades, foundations, materials, and structures damaged by water, both surface and sub-surface, to the lines, grades and conditions existing prior to the damage at no additional cost to the **County**.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 CARE OF WATER

A. Except where the excavated materials are designated as materials for permanent work, material from required excavation may be used for dikes, levees, cofferdams, and other temporary backfill if approved by the **County**.

B. Furnish, install, maintain, and operate necessary pumping and other equipment for dewatering the various parts of the Work and for maintaining the foundation and other parts free from water as required for constructing each part of the Work.

C. Install all drainage ditches, sumps, and pumps to control excessive seepage on excavated slopes, to drain isolated zones with perched water tables, and to drain impervious surfaces at final excavation elevation.

D. After they have served their purpose, remove all temporary protective work at a satisfactory time and in a satisfactory manner. All diversion channels and other temporary excavations in areas where the compacted fill or other structures will be constructed shall be cleaned out, backfilled, and processed under the same Specifications as those governing the compacted fill.

E. When the temporary works will not adversely affect any item of permanent work or the planned usage of the Project, the **Contractor** shall receive approval from the **County** to leave such temporary works in place. In such instances, breaching of

dikes, levees, and cofferdams may be required.

3.02 DEWATERING

A. By the use of well points, pumps, tile drains, or other approved methods, the **Contractor** shall prevent the accumulation of water in excavated areas. Should water accumulate, it shall be promptly removed.

B. As directed by the **County,** excavations shall be continuously dewatered to maintain a groundwater level no higher than two (2) feet below the lowest point in the excavation.

C. The **Contractor** shall use piezometric observation wells to monitor the groundwater level and to ensure proper dewatering prior to excavation below the static water table. The number of wells required will vary depending on the size and depth of structures.

D. No separate payment shall be made for dewatering required to accomplish the work.

+++ END OF SECTION 02140 +++

SECTION 02200
EARTHWORK

PART 1 – GENERAL

1.01 SCOPE

A. The work under this Section includes earthwork and related operations, including, but not limited to; excavating all classes of material encountered; trenching; handling; storage; transportation; and disposal of all excavated and unsuitable material; construction of fills and embankments; backfilling around structures; backfilling all pits; compacting; all sheeting; shoring and bracing; preparation of subgrades; surfacing and grading; and any other similar, incidental, or appurtenant earthwork operation that may be necessary to properly complete the Work.

B. The **Contractor** shall provide all services, labor, materials, and equipment required for all earthwork and related operations necessary or convenient to the **Contractor** for furnishing complete Work as shown on the Drawings or specified in these Contract Documents.

C. Related Work specified elsewhere:

1. Section 02324 – Trenching and Trench Backfilling

1.02 GENERAL

A. The elevations shown on the Drawings as existing are taken from the best available data and are intended to give reasonable information about the existing elevations. The **Contractor** shall verify conditions to determine the exact quantities of excavation and fill required.

B. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.

C. All excavated and filled areas for structures, trenches, fills, topsoil areas, embankments and channels shall be maintained by the **Contractor** in good condition at all times until final acceptance by the **County**. All damages and cost caused by erosion or other construction operations shall be the **Contractor's** responsibility and repaired by the **Contractor** using material of the same type as the damaged material at no cost to the **County**.

D. The **Contractor** shall control grading in a manner to prevent water running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water can flow uninterrupted in existing open ditches or channels; other surface drains; or temporary drains with the required E&S measures.

E. The soil testing shall be performed by the **Contractor**'s testing laboratory. As a minimum at least one (1) density test shall be performed for every five thousand

(5,000) square feet of fill area and every two (2) feet of fill lift. Extra tests may be required at the **County's** discretion.

F. Should the **County** choose to conduct its own testing, the **Contractor** shall make all necessary excavations and shall supply any samples of materials necessary for conducting compaction and density tests at no expense to the **County**. The cost of all retests made necessary by the failure of materials supplied by the **Contractor**, his agents or subcontractors, to conform to the requirements of these Contract Documents shall be paid by the **Contractor**. **Contractor** shall provide at least twenty-four (24) hours advance notice of earthwork operations to the Testing Laboratory. Testing Laboratory shall provide reports to the **County** with copies to the **Contractor** certifying (and sealed by a Registered Georgia Engineer) that earthwork is in conformance with the plans and specifications. The Testing laboratory shall witness the placement of all fill, unless otherwise directed by the **County**.

G. All earthwork operations shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations, and shall be conducted in a manner acceptable to the **County**.

H. Stockpile Areas: Provided there is space available, stockpiling material may be on site if approved by the **County** and protected by Environmental and Safety measures.

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300. In addition, the following specific information shall be provided:

1. Copies of permits obtained by the **Contractor** for the work.
2. Test results, certification of compliance, source, and samples for all imported materials.
3. Samples of fill materials to be used. Samples shall be submitted two (2) weeks in advance of use and shall consist of one-half (0.5) cubic feet of each type of material.
4. Test reports for compaction.

1.04 QUALITY ASSURANCE

A. Reference Standards. Comply with all Federal, State and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:

1. ASTM C136-84a, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D1556-82, Test Method for Density of Soils in Place by the Sand Cone Method.

3. ASTM D1557-78, Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using ten (10) lb. (4.5-kg) Rammer and eighteen (18) in. (457-mm Drop).
4. ASTM D3107-88, Test Method for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

PART 2 – PRODUCTS

2.01 MATERIALS

A. Earthwork Materials

1. Controlled Fill:

a. Proposed fill soils shall be laboratory tested prior to construction use to determine their suitability. All fill material shall be subject to the approval of the **County**.
b. Notification: For approval of imported fill material, notify the **County** and Testing Laboratory at least three (3) weeks in advance of intention to import material, designate the proposed borrow area, and permit the Testing Laboratory to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material. Test results shall be submitted to the **County** for approval. All fill shall be free of significant organic matter or debris, have a low to moderate plasticity, (PI<15) uniform composition, and be free of rock fragments greater than three (3) inches in dimension. Soils selected for use as fill material shall also have a standard Proctor (ASTM D 698) maximum dry density of at least ninety (90) pounds per cubic foot.
c. All onsite fill material shall be soil exclusive of organic matter, frozen lumps, or other deleterious substances.
d. It shall contain no rocks or earth clumps over three (3) inches maximum in dimension. However, the **County** reserves the right to approve larger or smaller sizes for different depths of fill.

2. Structural Fill and Structural Backfill:

a. Select on site materials may be suitable. Testing and recommendation of suitability shall be made by the Testing Laboratory and submitted by the **Contractor** to the **County** for approval.
b. Imported material shall be sand, uniformly graded crushed rock or other select material recommended by the Testing Laboratory and submitted by the **Contractor** to the **County** for approval. Graded aggregate base material as specified in Section 02060 is acceptable for structural fill and backfill.
c. Crushed Rock: Crushed rock used for bedding and drainage stone shall conform to the Georgia Department of Transportation

Standard Specifications for construction of Road and Bridges, Section 800 for No. 57 Stone.

3. Coarse Aggregate: Coarse aggregate shall conform to the Georgia Department of Transportation Standard Specifications of Transportation Systems construction of Road and Bridges, Section 800 for No. 57 Stone, Group II, and shall have the following gradation:

Sieve size	Percent Passing	
1-½ inch	100	-
1 inch	95	100
¾ inch	-	-
½ inch	25	60
3/8 inch	-	-
#4	0	10
#8	0	5

4. Top Soil: Dark organic weed free loam.

B. Sheeting, Bracing and Timbering: The **Contractor** shall furnish, place and maintain all sheeting, bracing and timbering required to properly support trenches and other excavations in open cut and to prevent all movement of the soil, pavement, structures, or utilities outside of the trench or pit.

1. General:

a. All cofferdams, sheeting, bracing, and timbering shall be designed, sealed, and signed by a registered Professional **County** in the State of Georgia at the **Contractor's** expense. A copy of the drawings and design computations shall be submitted to the **County** for the project files.

b. Sheeting, bracing and timbering shall be so placed as to allow the Work to be constructed to the lines and grades shown on the Drawings.

c. If at any time the method being used by the **Contractor** for supporting any material or structure in or adjacent to any excavation is not reasonably safe the **County** may require and the **Contractor** shall at their cost provide additional bracing and support necessary to furnish the added degree of safety. The **Contractor** shall provide such added bracing and support by such method as **Contractor** may elect to use, but the taking of such added precautions shall in no way relieve the **Contractor** of sole and final responsibility for the safety of lives, work, and structures.

d. All sheeting and shoring in contact with the concrete or masonry shall remain in place. The sheeting or shoring above the structure may remain in place or be cut off at the approval of the **County**. No sheeting shall be left in place within three feet below the ground surface unless it is in contact with the concrete or masonry

e. There shall be no payment for sheeting, bracing, shoring, and timbering left in place.

2. Timber:

   a. Timber may be substituted for steel sheet piling when approved by the **County**. Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations.
   b. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the work and adjacent property. Leave sheeting in place when it cannot be safely removed. Cut off sheeting left in place below the finished ground surface by three (3) feet unless in contact with the concrete or masonry.

3. Steel Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth, and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral or vertical movement at all times. In addition to the drawings and computations, the **Contractor** shall provide closure and sealing details between sheet piling and existing facilities, as well as method of excavation within sheet piling to the **County** for review before commencing construction operations. **Contractor** shall be responsible for all damage to existing utilities and structures resulting from installation of sheet piling. Damage to existing utilities and/or structures resulting from installation of sheet piling shall be repaired at the **Contractor**'s expense as well as all associated damages.

C. Other Materials: All other materials not specifically described but required for proper completion of the work of this Section, shall be as selected by the **Contractor** subject to the prior approval of the **County**.

D. Stockpile area: The stockpile area shown on the drawings, or as directed by the **County**, shall be used to stockpile soil material for backfilling around structures and to stockpile needed topsoil.

PART 3 – EXECUTION

3.01 GENERAL

A. Benching of Slopes: When the embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when the embankment is to be built one-half (½) width at a time, the slopes that are steeper than four to one (4:1) as measured at right angles to the embankment shall be continuously benched over those areas as the work is brought up in layers. Benching shall be of sufficient width to permit the operation of placing and compacting equipment. Each successive cut shall begin at the intersection of the original ground and the vertical side of the previous cut. Material thus cut shall be recompacted along with the new embankment material. Proof roll subgrade prior to placement of fill material.

B. Topsoil:

1. Remove all topsoil to a depth at which subsoil is encountered, from all areas, which are to be cut to lower grades or filled.
2. Topsoil to be used for finish grading may be stored on the site. It shall be piled properly, sloped to drain, and covered.

C. Bracing and Sheeting:

1. Furnish, install, and maintain all sheeting, bracing, and shoring as may be required to properly support the sides of all excavations and to prevent all movement of earth, which could in any way injure the work, adjacent property, or workmen.
2. Properly support all trenches for duct bank installation so as to conform to all pertinent rules and regulations and these Specifications. All trenches deeper than OSHA's maximum depth for no shoring shall be shored unless cut to the angle of repose of the excavated soils.
3. Exercise care in the removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of the excavation faces being supported and damage to the work and adjacent property.
4. Do not leave any sheeting or bracing in the trench or excavation after completion of the work, unless approved or instructed by the **County**. The cost of leaving sheeting or bracing shall be at the **Contractor**'s expense.
5. All sheeting and shoring in contact with concrete or masonry shall remain in place. The sheeting and shoring above the structure may remain or be cut off. No sheeting or shoring left in place shall be within three feet below the ground surface. Direction from the **County** is required when the sheeting or shoring is in contact with concrete or masonry and within three feet below ground surface.

D. Obstructions:

1. Remove and dispose of all trees, stumps, roots, boulders, pavement, pipes, and the like, as required for the performance of the work.
2. Exercise care in excavating around catch basins, inlets, manholes, piping, duct banks, underground vaults, etc.
3. Avoid removing or loosening castings or pushing dirt into structures.
4. Damaged or displaced castings shall be repaired and replaced, and dirt entering the structures or system during the performance of the work shall be removed and cleaned at no additional cost to the **County**.

E. Utilities to be Abandoned:

1. When pipes, conduits, sewers, or other structures are removed from the trench, leaving dead ends in the ground, such ends shall be fully plugged and sealed as indicated on the Drawings.
2. Abandoned structures such as manholes, catch basins or chambers shall be entirely removed and the void properly backfilled unless otherwise specified or indicated on the Drawings.
3. All materials from abandoned utilities that can be readily salvaged shall be

removed from the excavation and stored on the site at a location as directed by the **County**.

4. All salvageable materials shall remain the property of the **County** unless otherwise indicated by the **County**.

F. Extra Earth Excavation:

1. In case soft material, which, in the opinion of the **County** is not suitable, is encountered in the bottom of a trench or underneath a structure, the soft material shall be removed and replaced with structural fill or coarse aggregate.

G. Cutting Paved Surfaces and Similar Improvements:

1. Remove existing pavement as necessary for installing utilities and appurtenances or as otherwise shown on the Drawings.
2. Before removing any pavement, mark the pavement neatly, paralleling pipelines and existing street lines. Space the marks to match the width of the trench.
3. Break asphalt pavement along the marks by scoring with a rotary saw and breaking below the score by the use of jackhammers or other suitable tools.
   Break concrete pavement along the marks by scoring with a rotary saw and breaking below the score by the use of jackhammers or other suitable tools.
4. Do not pull pavement with machines until completely broken and separated from pavement to remain.
5. Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.
   NOTE: No additional payment shall be made for removing and replacing damaged adjacent pavement if negligence by the Contractor has occurred. This shall be the County's decision.
6. Remove and replace sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.
7. The **Contractor** may tunnel under curbs that are encountered. Remove and replace any curb disturbed by construction to the nearest undisturbed joint.

H. Dewatering:

1. The proposed dewatering plan shall be submitted by the **Contractor** to the **County** for approval at least ten (10) working days prior to the beginning of any excavation.
2. Furnish, install, maintain, and operate necessary pumping and other equipment for dewatering the various parts of the Work and for maintaining the foundation and other parts free from water as required for constructing each part of the Work.
3. By the use of well points, pumps, tile drains, or other approved methods, the **Contractor** shall prevent the accumulation of water in excavated

areas. Should water accumulate, it shall be promptly removed.

4. Excavations shall be continuously dewatered to maintain a ground water level no higher than three (3) feet below the lowest point in the excavation.
5. Piezometric observation wells shall be required, to monitor the ground water level, to ensure proper dewatering prior to excavation below the static water table. The number of wells required will vary depending on the size and depth of structures and shall be included in the plan.
6. The cost for all dewatering and discharge shall be at the **Contractor**'s expense and shall be considered incidental.

3.02 EXCAVATION

A. Method:

1. All excavation shall be by open-cut from the surface except as indicated on the Drawings.
2. All excavations for appurtenances and structures shall be made in such manner and to such depth and width as will give ample room for building the structures and for bracing, sheeting, and supporting the sides of the excavation, for pumping and draining groundwater and wastewater which may be encountered, and for the removal from the trench of all materials excavated.
3. Water shall not be allowed to accumulate in excavations. **Contractor** shall provide sufficient temporary pumping to ensure that surface and ground waters do not saturate foundation soils.
4. Take special care so that soil below the bottom of the structure to be built is left undisturbed.

B. Grades:

1. Excavate to lines and grades indicated on the Drawings.
2. Where excavation grades are not indicated on the Drawings, excavate as required to accommodate installation.

C. Disposal of Excavated Material:

1. Remove and legally dispose of all excavated material not needed to complete filling, backfilling, and grading.
2. Dispose of excess excavated material at locations secured by the **Contractor** and in accordance with all requirements of Federal, State, **County** and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or on any street or alley. No debris shall be deposited on any private property except by written consent of the property owner with the required **County** permits. In no case shall any material be left on the Project, or be buried in embankments or trenches on the Project. With recommendation of the Testing Laboratory and approval by the **County**, demolished, crushed concrete may be acceptable for use in fill areas.
3. Excavated materials shall be placed adjacent to the work to be used for backfilling as required.

4. Excavated materials shall be placed, meeting OSHA's minimum distance, sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and to not cause any drainage problem. Excavated material shall be placed so as to not damage existing landscape or man-made improvements. Surcharging of any bank is not allowed.

D. Rock Excavation:

1. Rock excavation shall mean rock requiring drilling and blasting that occupies an original volume of at least one (1) cubic yard. Rock shall be considered as material that cannot be removed with a crawler tractor equal to a D-8 Caterpillar, equipped with a single-tooth ripper or by an excavator track hoe equal to a Caterpillar 225 rated with a three-fourths (¾) cubic yard capacity with a bucket curling pullout capacity of twenty-five thousand (25,000) pounds.
2. Where rock is encountered within excavation for structures, it shall be excavated to the lines and grades indicated on the Drawings or as otherwise directed by the **County**. The **Contractor** shall be responsible for obtaining all blasting permits required.
3. If excess excavation is made or the material becomes disturbed so as to require removal below final subgrade elevations or beyond the prescribed limits, the resulting space shall be refilled with Class B concrete in accordance with Section 03300 - Cast-in-Place Concrete.

3.03 EXCAVATING FOR STRUCTURES

A. Excavation:

1. All excavation is unclassified and shall be included in the **Contractor's** Base Bid.
2. Excavation shall include all substances to be excavated. Excavation for structures shall be to limits not less than two (2) feet outside wall lines, to allow for formwork and inspection.
3. Where rock excavation is carried below grade the **Contractor** shall backfill to grade using concrete or structural fill.
4. Where unsuitable material is encountered excavate material to a depth acceptable to the **County** and fill with compacted structural fill as required.

B. Excavation for Foundations: Footings and slabs on grades shall rest on undisturbed earth, rock, or compacted materials to ensure proper bearing.

1. Unsuitable Foundation Material

a. All material in the opinion of the **County** that is unsuitable for foundation shall be removed and replaced with coarse aggregate or structural fill material as directed by the **County**.
b. No determination of unsuitability shall be made until

all requirements for dewatering are satisfactorily met.

2. Foundation in Rock: Foundations for a structure shall be on similar materials. Should excavation for a foundation be partially in rock, the **Contractor** shall undercut that portion of the rock twelve (12) inches and bring the excavation to grade with compacted crushed stone.

C. Construction Observations:

1. All excavations may be examined by the **County** prior to reinforcing steel placement to verify that the design bearing pressure is available. All excavations shall be clean, level, and free of ponded water, mud, and loose, frozen, or water-softened soils. If it is necessary for an excavation to remain open overnight, or if rain is imminent, a three to four (3 to 4) inch thick "mud mat" of Class B concrete may be placed in the bottom of the excavation to protect the bearing soils until reinforcing steel and concrete can be placed.

D. Unsuitable Bearing:

1. If unsuitable bearing for foundations is encountered at the elevations indicated on the Drawings, the **County** shall be notified immediately.

3.04 EXCAVATION BELOW GRADE AND REFILL

A. If the bottom of any excavation is taken out below the limits shown on the Drawings or specified, it shall be refilled to the bottom grade, at the **Contractor**'s expense, except where rock or unsuitable soil is encountered. The refill shall be six (6) inch layers of structural fill or other material satisfactory to the **County**. The type of material to be used shall be the **County's** option.

3.05 BACKFILL AND FILL PLACEMENT

A. Compaction of fill shall be accomplished by placing the fill material in horizontal lifts of eight inch (8) maximum loose thickness and mechanically compacting each lift to at least the specified dry density.

B. All fill placement shall be witnessed by an experienced soils technician of the Testing Laboratory and fill density and moisture tests for each lift shall be performed to verify that the specified degree of compaction is being achieved.

C. Prior to placement of any material in embankments, the area within embankment limits shall be stripped of topsoil and all unsuitable materials removed as described under Excavation. Area to receive fill shall then be scarified to a depth of at least six (6) inches.

D. The fill shall be brought to the proposed elevation by placing and compacting only approved fill materials upon a subgrade approved by the **County**.

E. Fill materials shall be placed in continuous approximately horizontal layers

extending the full width of the embankment cross-section and the full dimension of the excavation where practicable.

F. The fill shall be placed at a moisture content that corresponds to a +/- 3% of the optimum moisture content, as determined by the standard Proctor moisture-density relationship test.

G. Compaction:

1. The fill shall be uniformly compacted to a dry density that corresponds to at least ninety-five (95) percent of the standard Proctor maximum dry density (ASTM D 698) of the fill soil.
2. The upper twelve-inches (12”) of fill beneath the structures and pavement areas shall be compacted to ninety-eight (98) percent of the standard Proctor maximum dry density.
3. Scarification and re-compaction of the upper fill soils immediately prior to the slab-on-grade and/or pavement construction shall be required.
4. Compaction of embankments shall be by sheepsfoot rollers with staggered uniformly spaced knobs and suitable cleaning devices. The projected area of each knob and the number and spacing of the knobs shall be such that the total weight of the roller and ballast when distributed over the area of one (1) row of knobs shall be two hundred fifty (250) psi. Placement and compaction of materials shall extend beyond the final contours sufficiently to ensure compaction of the material at the resulting final surface. Final contours shall then be achieved by a tracked bulldozer or grader shaping the face of the embankment.
5. The backfill placement in trenches and behind structures shall be uniformly compacted to a dry density that corresponds to at least ninety-five (95) percent of the standard Proctor maximum dry density (ASTM D 698) of the fill soil. In confined areas requiring portable compaction equipment the fill material shall be placed in horizontal lifts of four (4) inch maximum loose thickness.
6. If tests indicate that density of backfill fill is less than that specified, the area shall be either be recompacted or undercut, filled, and compacted until specified density is achieved.
7. If compaction cannot be achieved by mechanical equipment, due to conflicts with utilities, flowable fill meeting the specifications be used with the **County’s** approval at the **Contractor’s** expense.

H. Final Grading: Upon completion of construction operations, the area shall be graded to finish contour elevations and grades shown on the Drawings. Graded areas shall be made to blend with remaining ground surfaces. All surfaces shall be left smooth and free to drain.

I. Moisture:

1. If fill material is too wet, provide and operate approved means to assist the drying of the fill until suitable for compaction.
2. If fill material is too dry, provide and operate approved means to add

moisture to the fill layers.

J. Proof rolling:

1. All areas where pavement or structures are to be built on compacted fill and other areas where indicated on the Drawings, shall be proof rolled to detect soft spots prior to the placement of fill material or construction of foundations.
2. Proof rolling shall consist of the moving a twenty to thirty (20 to 30) ton loaded dump truck or pneumatic tire roller over the subgrade after the subgrade is shaped. Proof rolling shall be witnessed by the **County**.
3. Pneumatic-tired rollers shall have not fewer than four pneumatic tired wheels which shall be of such size and ply that tire pressures can be maintained between eighty and one hundred (80 and 100) pounds per square inch for twenty-five thousand (25,000) pound wheel load during rolling operations. Unless otherwise required, rolling shall be done with tires inflated to ninety (90) psi. The roller wheels shall be located abreast in a rigid steel frame. Each wheel shall be loaded with an individual weight box so that each wheel shall bear an equal load when traversing uneven ground. The weight boxes shall be suitable for ballast loading such that the load per wheel shall be twenty-five thousand (25,000) pounds. The spacing of the wheels shall ensure that the distance between the nearest edges of adjacent tires shall be not greater than one-half of the tire width of a single tire at the operating pressure for a twenty-five thousand (25,000) pound wheel load. The roller shall be operated not faster than five (5) feet/second.
4. Subgrade shall be proof rolled with six (6) passes. Depressions that develop during the proof rolling operation shall be filled with suitable material and those filled areas shall be proof rolled with six (6) passes. If, after having been filled and proof rolled, the subgrade still contains depressions, the soil shall be undercut to the full depth of the soft material or five (5) feet, whichever is less, backfilled, and rolled to achieve a compacted subgrade.
5. After the proof rolled subgrade has been accepted by the **County**, the surface of the subgrade shall be finish rolled with a smooth steel wheel roller weighing not less than ten (10) tons. Finished surface of the subgrade shall be within a tolerance of four hundredths (0.04) of a foot at every point.
6. Conduits, pipes, culverts, and underdrains shall be neither disturbed nor damaged by proof rolling operations. Rollers shall neither pass over, nor approach closer than five (5) feet to conduits, pipes, culverts and underdrains unless the tops of those facilities are deeper than three (3) feet.

K. During wet or rainy periods, aeration (drying) shall be required to reduce the fill materials to the required moisture condition. During dry periods, water shall be added to achieve the proper moisture content for compaction. Silty soils, which are wet, shall require aeration prior to compaction even during dry periods.

3.06 BACKFILLING AROUND STRUCTURES

A. General:

1. Remove debris from excavations before backfilling.
2. Do not backfill against foundation walls until so instructed by the **County**
3. Wherever possible, backfilling shall be simultaneous on both sides of walls to equalize lateral pressures.
4. Do not backfill on only one (1) side of vertically spanning walls unless walls are adequately shored or permanent construction is in place to furnish lateral support on both top and bottom of wall.

3.07 GRADING

A. General:

1. Perform all rough and finish grading required to attain the elevations indicated on the Drawings.
2. Perform rough grading to an accuracy of plus or minus one tenth (0.10) of a foot.

B. Grading Around Buildings: Control the grading around buildings so the ground is pitched to prevent water from running into the excavated areas of a building or damaging other site features.

C. Treatment After Completion of Grading:

1. After grading is completed, permit no further excavation, filling or grading, except with the approval of the **County**.
2. Use all means necessary to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.08 EXCESS WATER CONTROL

A. Unfavorable Weather:

1. Do not place, spread, or roll any fill material during unfavorable weather conditions.
2. Do not resume operations until moisture content and fill density are satisfactory to the **County**.
3. Any inundated area that freezes shall be removed and refilled at the **Contractor**'s expense.

B. Provide berms or channels to prevent flooding of subgrade. Promptly remove all water collected in depressions.

C. Pumping, Drainage and Dewatering:

1. Provide, maintain, and use at all times during construction adequate means and devices to promptly remove and dispose of all water from every source entering the excavations or other parts of the Work.

2. Dewater by means, which shall ensure dry excavations, preserve final lines and grades, and do not disturb or displace adjacent soil.
3. All pumping and drainage shall be done with no damage to property or structures and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic or the work of other contractors, and in accordance with all pertinent laws, ordinances, and regulations.
4. Do not overload or obstruct existing drainage facilities.

3.09 SETTLEMENT

A. The **Contractor** shall be responsible for all settlement of backfill, fills, and embankments, which may occur within one (1) year after final acceptance of the Work by the **County**.

B. The **Contractor** shall make, or cause to be made, all repairs, or replacements made necessary by settlement within thirty (30) days after receipt of written notice from the **County**.

3.10 CLEANING

A. Upon completion of the work of this Section, remove all rubbish, trash, and debris resulting from construction operations in a lawful manner. Remove surplus equipment and tools. Leave the site in a neat and orderly condition acceptable to the **County**, and in conformance with the General Requirements of the Contract Documents.

+++END OF SECTION 02200+++

SECTION 02224
PIPE BORING AND JACKING

PART 1 – GENERAL

1.01 SCOPE

A. The work covered by this Section includes furnishing all labor, materials, and equipment required to bore and jack casings or construct tunneled crossings and to properly complete pipeline construction as described herein and/or shown on the Drawings.

B. General: Supply all materials and perform all work in accordance with applicable American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable. If requested by the **County**, submit evidence that the manufacturer has consistently produced products of satisfactory quality and performance over a period of at least two (2) years.

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300 - Submittals. In addition, the following specific information shall be provided:

B. Method Submittals: As directed by the **County,** the **Contractor** shall provide for the **County's** approval, a detailed plan for the methods proposed for the construction of the casing or tunnel. These plans shall address the following:

1. Tunneling Method:

a. Groundwater Control: The **Contractor** shall control the groundwater throughout the construction of the casing. The groundwater shall be controlled by dewatering (well points, sumps,
or deep wells), grouting, freezing, or other method approved by the **County**. The **Contractor** shall prepare a written, detailed plan for controlling groundwater, citing similar installation conditions and results. This plan shall be submitted to the **County** prior to any construction of the casing.

b. Face Protection: The face of the excavation shall be protected from the collapse of the soil into the casing or tunnel.

c. Casing Design: Design of the bore pit and required bearing to resist jacking forces is the responsibility of the **Contractor**. The excavation method selected shall be compatible with expected ground conditions. The lengths of the casing shown on the Drawings are the minimum lengths required. The length of the casing may be extended for the convenience of the **Contractor**, with the approval of the **County**, at no additional cost. Due to

restrictive right-of-way and construction easements, boring and jacking casing lengths less than the nominal length may be necessary.

2. Bore and Jack Method:

   a. With **County** approval, the **Contractor** has the option to select the bore and jack method, including groundwater control, except as restricted herein.
   b. The **Contractor** shall submit working drawings, written procedures, and calculations describing in detail the proposed bore and jack method and entire operation. This shall include, but not be limited to, groundwater control, ground stabilization if proposed, excavation procedures, control of casing alignment and grade, support of face, detection of surface movement, procedure for installing pipes and anchors and placement of an approved fill material between pipe and casing. If, in opinion of the **Contractor**, modifications to the methods are required during construction, working drawings shall be submitted for **County** approval delineating such modifications, including reasons for the modifications. Preparation of these drawings shall be at no cost to the **County**.

C. Material Submittals: The **Contractor** shall provide for the **County**'s approval, shop drawings, proposed construction drawings and other pertinent specifications and product data as follows:

1. Shop drawings for casing pipe and tunnel liner plate showing sizes and connection details
2. Design mixes for concrete and grout
3. Casing spacers

D. Experience Submittals:

Boring and jacking casings and tunnel construction is deemed to be specialty contractor work. If the **Contractor** elects to perform the work, the **Contractor** shall provide evidence of experience as required by the General Requirements of the Contract Documents. The **Contractor** proposed to do the work shall have a minimum of five (5) continuous years of experience in steel casing and tunnel construction. Evidence of this experience shall be provided with the shop drawings for approval by the **County**.

1.03 STORAGE AND PROTECTION

All materials shall be stored and protected in accordance with the Manufacturer's recommendations and as approved by the **County**.

PART 2 – PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

A. Casing:

1. The casing shall be new unused pipe made from steel plate having minimum yield strength of 35,000 psi. The steel plate shall also meet the chemical requirements of ASTM A36.
2. As directed by the **County**, the outside of the casing pipe shall be coated with coal tar epoxy having a minimum dry film thickness of sixteen (16) mils. Surface preparation shall be SSPC-SP-10. Epoxy shall have a minimum solids content of sixty-five (65) percent by volume and hall be air or airless spray applied, minimum drying time shall be seven (7) days. Brushing shall be permitted in small areas only. All coating and recoating shall be done in strict accordance with the manufacturer's recommendations. Epoxy shall be Tnemec, Kop-Coat, Valspar, or approved equal and submitted for approval by the **County**.
3. Minimum casing thicknesses are shown on the Drawings. Actual thicknesses shall be determined by the casing installer, based on an evaluation of the required forces to be exerted on the casing when jacking and all calculations shall be submitted for approval by the **County**. Any buckling of the casing due to jacking forces shall be repaired at no additional cost to the **County**.
4. Minimum diameters of casing are shown on the Drawings. Larger casings, with the **County**'s approval, may be provided at no additional cost to the **County**, for whatever reasons the **Contractor** may decide, whether due to casing size availability, line and grade tolerances, soil conditions, etc.

B. Liner Plate:

1. Liner plates shall be of the thickness shown on the Drawings. The liner plates shall be either the four (4) flange-type or the two (2) flange lap-joint-type. Bolts and nuts used with the two- (2)-flange plates shall be a minimum of five–eighths (5/8) inch in diameter and shall conform to the latest revision of ASTM A307 for plate thickness less than 0.209 inch, and ASTM A449 for plate thickness equal to or greater than 0.209 inch. Bolts and nuts used with four (4) flange plates shall be not less than one-half (½) inch in diameter for plate thicknesses to and including 0.179 inch and not less than five-eighths (5/8) inch in diameter for plates of greater thickness. The bolts and nuts shall be quick acting coarse thread and shall conform to ASTM A307, Grade A. Each ring shall have two (2) inch- diameter half-couplings and plugs for grouting, located as shown on the Detail Drawings. Liner plates, bolts, and calculations shall be submitted to the **County** for approval.

C. Casing Spacers:
Casing spacers shall meet one of the following requirements:

1. Casing spacers shall be flanged, bolt-on style with a two-section stainless steel shell lined with a PVC liner, minimum 0.09-inch-thick also

having a hardness of eighty-five to ninety (85 - 90) durometer. Runners shall be attached to stainless steel risers that shall be properly welded to the shell. The height of the runners and risers shall be manufactured such that the pipe does not float within the casing. Casing spacers shall be Cascade Waterworks Manufacturing Company, Advanced Products & Systems, Inc., or approved equal.

2. Casing spacers shall be a two-section, flanged, bolt-on style constructed of heat-fused PVC coated steel, minimum fourteen (14) gauge band and ten (10) gauge risers, with two (2) inch wide fiberglass reinforced polyester insula duty PVC inner liner, minimum 0.09 inch thick, having a hardness of eighty-five to ninety (85-90) durometer, and all stainless steel hardware shall be Pipeline Seal and Insulator, Ltd., or approved equal.
3. Casing spacers shall be designed for the general configuration shown in the Plans, including provisions for other conduits to be installed with the carrier pipe.

D. Carrier Pipe: Carrier pipes shall be as specified in Section 02665, Water Mains, and Accessories, or Section 02665 - Transmission Water Mains. All joints of pipe in casing shall be restrained.

E. Surface Settlement Markers: Surface settlement markers within pavement areas shall be P.K. nails. Surface settlement markers within non-paved areas shall be wooden hubs. The **Contractor** may submit alternate methods to the **County** for approval.

2.02 EQUIPMENT

A. Casings

1. A cutting head shall be attached to a continuous auger mounted inside the casing pipe.
2. On casing pipe for water lines over sixty (60) feet in length, the installation equipment shall include a steering head and a grade indicator.
3. The steering head shall be controlled manually from the bore pit. The grade indicator shall consist of a water level attached to the casing, which would indicate the elevation of the front end of the casing or some other means for grade indication approved by the **County**.

B. Tunnels

1. Tunnel Boring Machine (TBM)
   a. The TBM's design shall be submitted for approval by the **County**. The TBM shall be minimally equipped with disc cutters of diameter nineteen (19) inches or greater designed for operation at thrusts of up to seventy (70) kips per cutter.
   b. The TBM shall afford adequate protection against loss of ground and permit ground support adjacent to the tunnel face, as required by ground conditions.
   c. The TBM shall be equipped with a dust control system that includes a water spray system, dust shield, and dust scrubber

system.

d. The method used to advance the TBM shall ensure its correct alignment at all times, without binding or imposing excessive loads on the primary tunnel supports or upon the surrounding ground.

e. The TBM shall be equipped with a roll indicator and laser target system, which allows the operator to observe the machine's alignment and orientation (predictor system) from the control station.

f. The TBM shall be grounded in accordance with the latest requirements of the National Electrical Code and equipped with ground fault protection.

2. Other tunneling Equipment

a. Power machinery and tools within the tunnel shall be operated by electricity, compressed air, diesel with approved scrubber, or other approved power. Electrical tools and equipment shall be grounded in accordance with the latest equipments of the National Electrical Code.

b. All electrical equipment and power receptacles shall have appropriate ground fault protection.

c. Provide temporary electrical lights to properly and safely illuminate all part of the shafts and tunnel including special illumination at the working face. Lighting circuits shall be thoroughly insulated and separated from power circuits, and lights shall be enclosed in wire cages. Secure electrical permits required for successful completion of this work.

PART 3 – EXECUTION

3.01 GENERAL

A. Interpretation of soil investigation reports and data, investigating the site and determination of the site soil conditions prior to bidding is the sole responsibility of the **Contractor**. Rock and/or water, if encountered, shall not entitle the **Contractor** to additional compensation. The **Contractor** shall examine the geotechnical report and borings and obtain all additional information as required to assure that the system provided shall be capable of operating successfully given groundwater conditions, soil type, rock profile, potential for obstructions and all geotechnical parameters pertinent to this type of microtunneling. With approval from the **County**, the **Contractor** may perform additional soil investigation at no cost to the **County**.

B. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a twenty-four (24) hour basis keeping excavations free of water until the backfill operation is in progress. Dewatering shall be carried out in such a manner that removal of soil particles is held to a minimum. Dewatering shall comply with the approved Temporary and Permanent Erosion and Sediment Control Plan.

C. Methods of dewatering shall be at the option and responsibility of the

Contractor. Maintain close observation to detect settlement or displacement of surface facilities due to dewatering. Should settlement or displacement be detected, notify the **County** immediately and take such action as necessary to maintain safe conditions and prevent damage.

D. Casing and tunnel construction shall be performed so as not to interfere with, interrupt or endanger roadway surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the work. Support the ground continuously in a manner that shall prevent loss of ground and keep the perimeters and face of the casing, passages and shafts stable. The **Contractor** shall be responsible for all settlement resulting from operations and shall repair and restore all damaged property to its original or better condition and is responsible for all associated damages at no cost to the **County**.

3.02 SAFETY

A. Provide all necessary bulkheads and shields to ensure complete safety to all traffic, persons, and property at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it in those areas immediately adjacent and outside the active project work area.

B. Perform all activities in accordance with the Occupational Safety and Health Act of 1970, OSHA, PL-596), as amended, applicable regulations of the Federal Government, OSHA 29CFR 1926 and applicable criteria of ANSI A10.16-81, "Safety Requirements for Construction of Tunnel Shafts and Caissons."

3.03 SURFACE SETTLEMENT MONITORING

A. Provide surface settlement markers, placed as specified and as directed by the **County**. The **Contractor** shall place settlement markers outside the pavement area, along the centerline of the casing or tunnel at twenty (20) foot intervals. Markers shall also be placed at each shoulder of the roadway, at each edge of pavement, at the centerline of the pavement, and at ten and twenty-five (10 and 25) feet offset in each direction from the centerline of the casing. Tie settlement markers to benchmarks and indices sufficiently removed as not to be affected by the **Contractor's** operations.

B. Make observations of surface settlement markers, placed as required herein, at intervals acceptable to the **County**. In the event settlement or heave on any marker exceeds one (1) inch, the **Contractor** shall immediately cease work and, using a method submitted to and approved by the **County**, take immediate action to restore surface elevations to those existing prior to start of the **Contractor's** operations.

C. Take readings and permanently record surface elevations prior to the start of dewatering operations and/or shaft excavation. The following schedule shall be used for obtaining and recording elevation readings: all settlement markers, once a week; all settlement markers within fifty (50) feet of the casing or tunnel

heading, at the beginning of each day; more frequently at the **County's** direction if settlement is identified. Make all elevation measurements to the nearest one hundredth (0.01) of a foot.

D. The **Contractor** shall cooperate fully with jurisdictional personnel. Any settlement shall be corrected by and at the expense of the **Contractor**.

E. Promptly report any settlement and horizontal movement immediately to the **County** and take immediate remedial action at no cost to the **County**.

3.04 BORING AND JACKING

A. Shaft

1. Conduct boring and jacking operations from a shaft excavated at one (1) end of the section to be bored. Where conditions and accessibility are suitable, place the shaft on the lower elevation end of the bore.
2. The shaft shall be rectangular and excavated to a width and length required for ample working space. If necessary, sheet and shore shaft properly on all sides. Shaft sheeting shall be timber or steel piling of ample strength to safely withstand all structural loadings of whatever nature due to site and soil conditions. Keep preparations dry during all operations. Perform shaft dewatering operations as necessary to maintain the integrity of the shaft and foundation.
3. The bottom of the shaft shall be firm and unyielding to form an adequate foundation upon which to work. In the event the shaft bottom is not stable, excavate to such additional depth as required and place a gravel sub- base or a concrete sub-base to create the support necessary to perform the required boring and jacking operation at no extra cost to the **County**.

B. Jacking Rails and Frame

1. Set jacking rails to proper line and grade within the shaft. Secure rails in place to prevent settlement or movement during operations. The jacking rails shall cradle and hold the casing pipe on true line and grade during the progress of installing the casing.
2. Place backing between the heels of jacking rails and the rear of the shaft. The backing shall be adequate to withstand all jacking forces and loads. The **Contractor** shall submit calculations detailing the wall pressures exerted by the jacking operations for the full length of the jack distance.
3. The jacking frame shall be of adequate design for the magnitude of the job. Apply thrust to the end of the pipe in such a manner to impart a uniformly balanced load to the pipe barrel without damaging the joint ends of the pipe.

C. Boring and jacking of casing pipes shall be accomplished by the dry auger boring method without jetting, sluicing, or wet boring.

D. Auger the hole and jack the casing through the soil simultaneously.

E. Bored installations shall have a bored-hole diameter essentially the same as the outside diameter of the casing pipe to be installed.

F. Execute boring ahead of the casing pipe with extreme care, commensurate with the rate of casing pipe penetration. Boring may proceed slightly in advance of the penetrating pipe and shall be made in such a manner to prevent any voids in the earth around the outside perimeter of the pipe. Make all investigations and determine if the soil conditions are such as to require the use of a shield.

G. Alignment and grade shall be monitored with a state-of-the-art laser system. As the casing is installed, check the horizontal and vertical alignment frequently. Make corrections prior to continuing operation.

H. Any casing pipe damaged in jacking operations shall be repaired, if approved by the **County**, or removed and replaced at the **Contractor**'s own expense.

I. Lengths of casing pipe, as long as practical, shall be used except as restricted otherwise. Joints between sections shall be completely welded in accordance with AWS recommended procedures. Prior to welding the joints, the **Contractor** shall ensure that both ends of the casing sections being welded are square.

J. The **Contractor** shall submit for approval to the **County** a contingency plan that shall allow the use of a casing lubricant, such as bentonite, in the event excessive frictional forces jeopardize the successful completion of the casing installation.

K. Once the jacking procedure has begun, it shall be continued without stopping until completed, subject to weather and conditions beyond the control of the **Contractor**.

L. Care shall be taken to ensure that casing pipe installed by boring and jacking method shall be at the proper alignment and grade.

M. The **Contractor** shall maintain and operate pumps and other necessary drainage system equipment to keep work dewatered at all times.

N. Adequate sheeting, shoring and bracing for embankments, operating pits and other appurtenances shall be placed and maintained to ensure that work proceeds safely and expeditiously. Upon completion of the required work, sheeting, shoring, and bracing shall be left in place, cut off, or removed, as directed by the **County**.

O. Refer to Section 02200 - Earthwork, and Section 02324 - Trenching and Trench Backfilling, for additional information related to trench excavation, all classes and types of excavation, the removal of rock, muck and debris, and the excavation of all working pits and backfill.

3.05 TUNNELS

A. Shaft Excavation

1. Excavate in such a manner that overbreak is held to a minimum. In soil and mixed-face conditions, install primary support in continuous and close contact with the excavated surface to control water inflow and prevent ground loss, so that adjacent structures are not affected by ground movements. Excavation in soil shall not be advanced ahead of the previously installed primary support any more than is necessary for the installation of the succeeding section of primary support.
2. Whenever shaft sinking is suspended, the **Contractor** shall complete prairie support to the excavated surfaces and keep all dewatering system(s) operating. The **Contractor** shall have qualified personnel periodically check conditions that might threaten the excavation stability.
3. Remove excavated soil and rock from the site and dispose of properly complying with all applicable local, state, and federal requirements regarding materials, methods of work, and disposal of excess and waste materials. All required inspections, permits, and fees are the **Contractor's** responsibility and at no cost to the **County**. **County**.
4. Remove sheeting used for shoring from the shaft and off the job site. The removal of sheeting, shoring, and bracing shall be done in such a manner as not to endanger or damage new or existing structures, private or public properties and to avoid cave-ins or sliding in the banks.

B. Tunnel Excavation

1. Excavate in such a manner that overbreak is held to a minimum.
2. Where water inflows in the tunnel face are large and increasing, the **County** shall be notified of the conditions requiring the supplemental actions. The **Contractor** shall take all necessary actions to mitigate the water flows, including, but not limited to, drilling probe holes, relief holes, and ground treatment holes in the tunnel face, and to carry out consolidation grouting before proceeding.
3. Whenever tunneling is suspended, the **Contractor** shall complete installation of the primary support for that excavation cycle, and have qualified personnel periodically check conditions that might threaten tunnel stability.
4. Remove excavated rock from the excavation of the TBM erection as well as from transit and reception chambers, and dispose of properly at a location secured by the **Contractor**.

C. The **Contractor** shall submit to the **County** for approval, a grouting schedule based on liner plate completion in time intervals and distances. The liner plates shall be installed progressively as excavation proceeds. Excavation shall not continue more than twenty-four (24) inches past the end of the liner plate already in place. At this time, an additional section of liner shall be installed before excavation shall continue. Grout shall be placed under pressure in the annular void as the excavation proceeds. Grout shall be continuously placed as close to the heading as possible, using grout stops if necessary. Grout shall be injected in the lower holes first, moving upward as the back space is filled. Threaded plugs shall be installed after filling each grout hole.

3.06 VENTILATION AND AIR QUALITY

Provide, operate, and maintain for the duration of the casing project, a ventilation system to meet safety and OSHA requirements.

3.07 ROCK EXCAVATION IN CASING

A. In the event that rock is encountered during the installation of the casing pipe that, in the opinion of the **County**, cannot be removed through the casing, the **County** may authorize the **Contractor** to complete the crossing with a tunnel.

B. With the **County's** approval, the **Contractor** may continue to install the casing and remove the rock through the casing at no additional cost to the **County**.

3.08 INSTALLATION OF PIPE

A. After construction of the casing or tunnel is complete, and has been accepted by the **County**, install the pipeline in accordance with the Drawings and Specifications.

B. Check the alignment and grade of the casing and submit a plan to the **County** for approval to set the pipe at proper alignment, grade, and elevation, without any sags or high spots.

C. The carrier pipe shall be held in the casing pipe by the use of casing spacers. The casing spacers shall be designed by the **Contractor** such that the carrier pipe can be installed in the casing. For tunnels, the carrier pipe shall be held in place with a steel strap per the details.

D. With **County** approval and as directed by the **County**, close the ends of the casing or tunnel with four (4) inch brick walls, plastered with Portland cement mortar and waterproofed with asphaltic roofing cement.

3.09 SHEETING REMOVAL

Remove sheeting used for shoring from the shaft and off the job site. The removal of sheeting, shoring, and bracing shall be done in such a manner so as not to endanger or damage either new or existing structures or private or public properties, and to avoid cave-ins, subsidence, or sliding in the banks.

+++ END OF SECTION 02224 +++

SECTION 02231
TREE PROTECTION AND TRIMMING

PART 1 - GENERAL

1.01 SCOPE

A. This section includes the protection and trimming of trees that interfere with, or are affected by, execution of the Work, whether temporary or new construction.

B. Related Work specified elsewhere:

1. Section 02200 - Earthwork
2. Section 02324 - Trenching and Trench Backfilling
3. Section 02920 - Site Restoration

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300. In addition, the following specific information shall be provided:

1. Product Data: For each type of product indicated.

2. Qualification Data: For firms and persons specified in the “Quality Assurance” Article to demonstrate their capabilities and experience. The **Contractor** shall include lists of completed projects with project names and addresses, names and addresses of engineers and owners, and other information specified.

3. Certification: From a qualified forester that trees indicated to remain have been protected during construction according to recognized standards and that the trees were promptly and properly treated and repaired when damaged.

4. Maintenance Recommendations: From a certified arborist for care and protection of trees affected by construction during and after completing the Work.

1.03 QUALITY ASSURANCE

A. Reference Standards: The **Contractor** shall comply with the applicable provisions and recommendations of the latest editions of the following standards, except as otherwise shown on the Plans or specified in these Specifications.

1. Hortus Third: Concise Dictionary of Plants Cultivated in the U.S. and County, 1976.
2. Standardized Plant Names (American Joint Committee on Horticulture Nomenclature).

3. National Arborist Association “Pruning Standards for Shade Trees”, latest revision.

4. ANSI A 300 – Trees, Shrubs, and Other Woody Plant Maintenance – Standard Practices.
5. ASTM D 448 – Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
6. ASTM D 5268 – Standard Specification for Topsoil Used for Landscaping Purposes.

B. Forester Qualifications: A forester licensed in the State of Georgia.

C. Tree Pruning Standards: The **Contractor** shall comply with the requirements of ANSI A300 unless more stringent requirements are indicated.

D. Pre-installation Conference: The **Contractor** shall conduct a pre-installation conference at the site of the Work.

Before starting tree protection and trimming, the **Contractor** shall meet with representatives of authorities having jurisdiction, including, the **County**, consultants, and other concerned entities. The **Contractor** shall review tree protection and trimming procedures and responsibilities. The **Contractor** shall notify participants at least three (3) working days before convening the conference. The **Contractor** shall record discussions and agreements and furnish a copy to each participant.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D448, Size 24, with ninety (90) to one hundred (100) percent passing a two and one half (2½) inch sieve and not more than ten (10) percent passing a three quarter (¾) inch sieve.

B. Topsoil: Fertile, friable, surface soil, containing natural loam and complying with the requirements of ASTM D5268. The **Contractor** shall provide topsoil that is free of stones larger than one (1) inch in any dimension and free of other extraneous or toxic matter harmful to plant growth. The **Contractor** shall obtain topsoil only from well-drained sites where soil occurs in depth of four (4) inches or more; the **Contractor** shall not obtain topsoil from bogs or marshes.

C. Filter Fabric: Manufacturer’s standard, non-woven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

D. Webbed Fabric Fence (temporary fencing): Orange polyethylene webbed fabric, forty-six (46) inches high supported by six (6) feet steel channel posts, five (5) feet on center. The **Contractor** shall set posts two (2) feet below grade.

E. Chain Link Fence: Shall meet the requirements of the approved plans and

submittals.

PART 3 - EXECUTION

3.01 IDENTIFICATION

A. Prior to any construction, the **Contractor** shall flag all trees on the site of the Work scheduled to be protected. All flagging shall be approved by the **County** prior to startup of the Work and construction activities. The **County** shall be notified immediately of any conflicts with proposed Work, structures, or utilities.

3.02 PREPARATION

A. Temporary Fencing: The **Contractor** shall install temporary fencing as indicated on the Plans or outside the drip line of trees to protect remaining vegetation from construction damage.

The **Contractor** shall install chain link fence according to the requirements of the approved plans and submittals.

B. The **Contractor** shall protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. The **Contractor** shall protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.

C. The **Contractor** shall not store construction materials, debris, or excavated material within the drip line of remaining trees. The **Contractor** shall not permit vehicles or foot traffic within the drip line. The **Contractor** shall prevent soil compaction over root systems.

D. The **Contractor** shall not allow fires under or adjacent to remaining trees or other plants.

3.03 EXCAVATION

A. The **Contractor** shall install shoring or other protective support systems to minimize sloping or benching of excavations that could endanger trees.

B. The **Contractor** shall not excavate within drip line of trees, unless otherwise indicated or approved by the **County**

C. Where excavation for new construction is required within drip line of trees, the **Contractor** shall hand-clear and excavate to minimize damage to root systems. The **Contractor** shall use narrow-tine spading forks and comb soil to expose roots.

1. The **Contractor** shall relocate roots in backfill areas where possible. If encountering large, main lateral roots, the **Contractor** shall expose roots beyond excavation limits as required to bend and relocate them without breaking. If encountered immediately adjacent to the location of new

construction and relocation is not practical, the **Contractor** shall cut roots approximately three (3) inches back from new construction.

2. The **Contractor** shall not allow exposed roots to dry out before placing permanent backfill. The **Contractor** shall provide temporary earth cover or pack with peat moss and wrap with burlap. The Contactor shall water and maintain earth in a moist condition. The **Contractor** shall temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

D. Where utility trenches are required within drip line of trees, the **Contractor** shall tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

Root Pruning: The **Contractor** shall not cut main lateral roots or taproots. The **Contractor** shall cut only smaller roots that interfere with installation of utilities. The **Contractor** shall cut roots with sharp pruning instruments. The **Contractor** shall not break or chop roots.

3.04 REGRADING

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, the **Contractor** shall slope grade away from trees as recommended by the forester, unless otherwise directed by the **County**.

B. Root Pruning: The **Contractor** shall prune tree roots exposed during grade lowering. The **Contractor** shall not cut main lateral roots or taproots. The **Contractor** shall cut only smaller roots. The **Contractor** shall cut roots with sharp pruning instruments. The **Contractor** shall not break or chop roots.

C. Minor Fill: Where existing grade is six (6) inches or less below elevation of finish grade, the **Contractor** shall fill with topsoil. The **Contractor** shall place topsoil in a single un-compacted layer and hand grade to required finish elevations.

D. Moderate Fill: Where existing grade is more than six (6) inches, but less than twelve (12) inches below elevation of finish grade, the **Contractor** shall place drainage fill, filter fabric, and topsoil on existing grade as follows:

1. Carefully place drainage fill against tree trunk approximately two (2) inches above elevation of finish grade and extend not less than eighteen (18) inches from the tree trunk on all sides. For balance of area within drip line perimeter, the **Contractor** shall place drainage fill up to six (6) inches below elevation of grade.

2. The **Contractor** shall place filter fabric with edges overlapping six (6) inches minimum.

3. The **Contractor** shall place fill layer of topsoil to finish grade. The **Contractor** shall not compact drainage fill or topsoil. The **Contractor** shall hand-grade to required finish elevations.

3.05 TREE PRUNING

A. The **Contractor** shall prune remaining trees affected by temporary and new construction.

B. The **Contractor** shall prune remaining trees to compensate for root loss caused by damaging or cutting root system. The **Contractor** shall provide subsequent maintenance during Contract period as recommended by the forester.

C. Pruning Standards: The **Contractor** shall prune trees according to the most current revision of ANSI A300 following the following types of pruning:

1. Crown cleaning
2. Crown thinning
3. Crown raising
4. Crown reduction
5. Vista pruning
6. Crown restoration

D. The **Contractor** shall cut branches with sharp pruning instruments. The **Contractor** shall not break or chop branches.

E. The **Contractor** shall chip branches removed from trees. The **Contractor** shall spread chips where indicated or as directed by the **County**.

3.06 TREE REPAIR AND REPLACEMENT

A. The **Contractor** shall promptly repair trees damaged by construction operations within twenty-four (24) hours. The **Contractor** shall treat damaged trunks, limbs, and roots according to written instructions of the certified arborist.

B. The **Contractor** shall remove and replace dead and damaged trees that the certified arborist determines to be incapable of restoring to a normal growth pattern.

C. The **Contractor** shall aerate surface soil compacted during construction ten (10) feet beyond drip line and no closer than thirty-six (36) inches to tree trunk. The **Contractor** shall drill two (2) inch diameter holes a minimum of twelve (12) inches deep at twenty-four (24) inches on center. The **Contractor** shall backfill holes with an equal mix of augered soil and sand.

3.07 DISPOSAL OF WASTE MATERIALS

A. Burning at the site of the Work is not permitted.

B. Disposal: The **Contractor** shall remove excess excavated material, displaced trees, and excess chips from the site and dispose of them at an approved location.

3.08 MAINTENANCE

A. All protected trees that have been root pruned shall be watered deeply twice a week during periods of hot, dry, windy weather (defined as when daily temperatures rise over eighty-five (85) degrees with no rain in the last 72 hours).

3.09 REPLACEMENT

A. The **Contractor** shall be responsible for replacement of all protected trees that are damaged or destroyed during the construction period. Replacement shall be in equal caliper inches (D.B.H.) to those trees damaged or destroyed and shall be in like species unless otherwise determined by the **County**.

3.10 ADJUSTING AND CLEANING

A. At the end of the construction period, the **Contractor** shall remove all protection fencing, trash, and debris within the protection area and finish grade and cover in accordance with the requirements of these Specifications.

+++ END OF SECTION 02231 +++

SECTION 02302
GRANITE CURB

PART 1 - GENERAL

1.01 SCOPE

A. The work covered under this section includes furnishing all labor, equipment, and materials required to furnish and set granite curb in accordance with the Plans and Specifications, where shown on the plans or directed by the **County**.

B. Related Work Specified Elsewhere:

1. Section 02000 – Earthwork

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300. In addition, the following specific information shall be provided:

1. Two (2) samples of finished product granite curb two (2) feet in length.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The granite curbs shall be type A granite curbs and shall match exactly the existing curbs in color, texture and size. The **Contractor** shall submit adequate samples to the **County** for approval.

B. All granite material shall first be approved by the **County** before any ordering or installation occurs.

C. All granite curb shall be tough, sound, durable, uniform in color, and free from rifts, seams, and laminations. They shall be not less than three (3) feet nor more than eight (8) feet in length, eighteen to twenty-four (18 to 24) inches in depth and matched width at the top to be six (6) inches. The granite shall be as shown on the drawings.

D. The front of all curb stone shall have a batter finished surface with a three quarters (3/4) inch bullnose at the battered edge. The granite shall have no depressions greater than one-quarter (1/4) inch from a straight edge the same length as the stone. The remainder of the face shall be free from projections greater than one half (1/2) inch, and the back for three (3) inches down from the top shall be satisfactorily dressed. The ends for the full width of the stone to a point fourteen (14) inches down from the top of the curb shall be close jointed, square to the top and face; the remainder of the end shall be cut so that there shall be a fairly close joint. The bottom of the stones shall be roughly squared.

2.02 FINISH

A. The granite curb shall have a sawn finish on the top and a split finish on the face of the curb. The **County** shall approve all curbing before the **Contractor** orders or installs.

PART 3 - EXECUTION

3.01 SETTING

A. Curb shall be set with close joints. The top front edge of the curb shall present a fair and unbroken line and the face a plane surface with a batter of one to twelve (1 to 12). The curbstone at the comers of intersecting joints shall be of the same quality as the curb hereinbefore specified and shall be set in the same manner. On curbs, where drainage basins are located, such special shaped stones as may be required shall be furnished and set. At ramps and wherever required, special shaped stones shall be furnished and set.

B. Curb trenches shall be opened to their full width and depth well in advance of the setting of the curb. The foundation for curb shall be concrete. The bottom layer of concrete shall be six (6) inches thick; the concrete in front and back of the curb shall be deposited simultaneously to the required height. Backfill and compaction shall meet minimum requirements.

+++ END OF SECTION 02302 +++

SECTION 02324
TRENCHING AND TRENCH BACKFILLING

PART 1 - GENERAL

1.01 SCOPE

A. The Work covered under this section consists of furnishing all labor, equipment, and materials and performing all operations in connection with the trench excavation and backfill required to install the pipelines shown on the Plans and as specified in these Specifications and the DeKalb County Department of Watershed Management Design Standards Manual.

B. Excavation shall include the removal of all trees, stumps, brush, debris, or other obstacles that remain after the site preparation operations and that may obstruct the Work. Excavation shall also include the excavation and removal of all earth, rock, or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the Plans and as specified in these Specifications.

C. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.

D. Trenches are divided into five areas:

1. Foundation: The area beneath the bedding, sometimes also referred to as trench stabilization.

2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.

3. Haunch: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.

4. Initial Backfill: The area above the haunching material and below a plane 12 inches above the top of the barrel of the pipe.

5. Final Backfill: The area above a plane 12 inches above the top of the barrel of the pipe.

E. The choice of method, means, techniques, and equipment rests with the **Contractor**. The **Contractor** shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material, proximity of man-made improvements to be protected, available easement or right-of-way, and prevailing practice in the area.

F. When hazardous or contaminated materials are encountered while performing trench excavation, the **Contractor** shall stop work and report the hazardous or

contaminated materials to the **County** immediately. The **County** will instruct the **Contractor** on the required procedures.

G. Related Work Specified Elsewhere:

1. Section 01210 - Measurement and Payment
2. Section 02200 - Earthwork
3. Section 02140 - Dewatering
4. Section 02535 - Gravity Flow Sanitary Sewers

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300. In addition, the following specific information shall be provided:

1. The **Contractor** shall submit a work plan for trenching and trench backfilling with complete written description that identifies details of the proposed method of construction and the sequence of operations for construction relative to trenching and trench backfilling. The descriptions, with supporting illustrations, shall be sufficiently detailed to demonstrate to the **County** that the procedures meet the requirements of the Plans and these Specifications.

2. The **Contractor** shall submit a dewatering plan in accordance with the requirements of Section 02140 - Dewatering.

3. The **Contractor** shall submit backfill material sources and product quality information.

4. The **Contractor** shall submit record documents in accordance with the requirements of the General Conditions. The **Contractor** shall record locations of sewers, as installed, referenced to survey benchmarks. The **Contractor** shall include locations of utilities encountered or rerouted. The **Contractor** shall give horizontal dimensions, elevations, inverts, and gradients. The **Contractor** shall use either GPS technology or a conventional survey to locate utilities.

5. The laboratory shall submit the following reports directly to the **County** from the testing services, with a copy to the **Contractor**.

   a. Test reports on borrow material
   b. Verification of each footing subgrade
   c. Field density test reports
   d. One (1) optimum moisture-maximum density curve for each type of soil encountered
   e. Report of actual unconfined compressive strength and/or results of bearing tests of each of the strata tested

1.03 QUALITY ASSURANCE

A. Reference Standards: The **Contractor** shall comply with the applicable provisions and recommendations of the latest editions of the following standards, except as otherwise shown on the Plans or specified in these Specifications.

1. ASTM C33 - Concrete Aggregates
2. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
3. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 or 600 kN-m/m^3)
4. ASTM D2922 - Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)
5. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method
6. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 or 2,700 kN-m/m^3)
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

B. Density: All references to "maximum dry density" shall mean the maximum dry density defined by ASTM D1557, except that for cohesionless, free-draining soils, "maximum dry density" shall mean the maximum index density as determined by ASTM D4253. Determination of the density of foundation, bedding, haunching, or backfill materials in place shall meet the requirements of ASTM D1556 and ASTM D2922.

C. Sources and Evaluation Testing: Testing of materials to certify conformance with these Specifications shall be performed by an independent testing laboratory approved by the **County**.

1.04 SAFETY

The **Contractor** shall perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The **Contractor** shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P "Excavation, Trenching & Shoring" as described in OSHA publication 2226.

1.05 TESTING

A. Tests and analysis of fill and borrow material shall be performed in accordance with the requirements of ASTM D1557.

B. Testing shall be performed by an approved independent commercial testing laboratory. The **Contractor** shall coordinate testing.

C. Compaction testing shall be performed in accordance with the requirements of ASTM D1556 or ASTM D2292.

D. If tests indicate Work does not meet specified requirements, the **Contractor** shall remove Work, replace, and retest at no cost to the **County**.

1.06 JOB CONDITIONS

A. All operations shall be performed by the **Contractor** in strict conformance with OSHA and any applicable local safety requirements. The **Contractor** shall pay particular attention to safety regulations for excavations and entering confined spaces.

B. Test borings and other exploratory operations may be made by the **Contractor** with **County** approval at no cost to the **County**.

C. The **Contractor** shall verify that survey benchmarks and intended elevations for the Work are as indicated on the Plans.

D. It is intended that the Plans show the locations of all known existing surface and subsurface structures. However, the locations of many gas mains, water mains, conduits, sewers, is unknown and the **County** assumes no responsibility for failure to show any or all of these structures on the Plans or to show them in their exact locations. It is mutually agreed that such failure shall not be considered sufficient basis for claims for Extra Work or for increasing the pay quantities, unless an obstruction encountered is such as to necessitate substantial changes in the lines or grades or requires the building of special structures, provisions for which are not made in the Plans. Any substantial change shall be determined and approved by the **County**.

E. The **Contractor** shall locate existing underground utilities in the site of the Work. If utilities are to remain in service and in place, the **Contractor** shall provide adequate means of support and protection during trenching and trench backfilling.

F. Utilities Notification Prior to Construction:
   1. Georgia law mandates that, before beginning all mechanical digging or excavation work, the **Contractor** shall contact Georgia 811 by using eRequest on www.Georgia811.com or by calling 811 or 1-800-282-7411.
   2. The **Contractor** may utilize EDEN (Excavation Digging Event Notification) web application that enables Members and Professional Excavators to create, manage, respond to, and edit Georgia 811 Locate Request Tickets.
   3. The **Contractor** shall retain all records of notification and responses during the course of the project until final Payment.

G. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, the **Contractor** shall consult the utility owner immediately for directions. The **Contractor** shall cooperate with utility companies in keeping respective services and facilities in operation. The **Contractor** shall repair damaged utilities to the satisfaction of the utility owner and shall be responsible for all costs associated with the repair or replacement of the damaged utility facilities.

H. Unless specified otherwise in other Specifications Sections, the **Contractor** shall not interrupt existing utilities serving any facilities, during occupied hours, except

when permitted in writing by the **County** and then only after acceptable temporary, utility services have been provided.

I. The **Contractor** shall provide a minimum of forty-eight (48) hour notice to the **County** and utility owner, and shall receive written notice to proceed before interrupting any utility.

J. The **Contractor** shall demolish and completely remove from the site of the Work existing underground utilities indicated on the Plans to be removed. The **Contractor** shall coordinate with utility companies for shut-off of services if lines are active. No separate payment shall be made by the **County**.

K. The **Contractor** shall protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavations. Where indicated in the Plans or directed by the **County**, the **Contractor** shall use augured piles and lagging. Augured piles shall be used instead of vibratory driven piles when near structures or existing sewers.

L. The **Contractor** shall notify the **County** of unexpected subsurface conditions and discontinue work in affected area until the **Contractor** receives notification to resume work.

M. The **Contractor** shall protect the bottom of the trench and soil adjacent to and beneath trench from frost.

N. The **Contractor** shall prevent surface water run-off into a trench.

PART 2 - PRODUCTS

2.01 TRENCH FOUNDATION MATERIALS

Crushed stone shall be utilized for trench foundation (trench stabilization) and shall meet the requirements of the Georgia Department of Transportation Specifications Construction of Transportation Systems 800.2.01, Group I (limestone, marble, or dolomite) or Group II (quartzite, granite, or gneiss). Stone size shall be between No. 57 and No. 4, inclusive.

2.02 BEDDING AND HAUNCHING MATERIALS

A. Unless specified otherwise, bedding and haunching materials shall be crushed stone as specified below.

B. Crushed stone utilized for bedding and haunching shall meet the requirements of Section 02060 - Crushed Stone Aggregate and of the Georgia Department of Transportation Specifications Construction of Transportation Systems 800.2.01, Group I (limestone, marble, or dolomite) or Group II (quartzite, granite, or gneiss). Stone size shall be No. 57.

C. Filter Fabric - Non-Woven Type:

1. Filter fabric associated with bedding shall be a UV stabilized, spun-bonded, continuous filament, needle-punched, polypropylene, nonwoven geotextile.

2. The fabric shall have an equivalent open size (EOS or AOS) of 120 to 70. The fabric shall also conform to the minimum property values listed in the following table:

Fabric Property	**Unit**	**Test Procedure**	**Average Value**	
			Typical	**Min-imum**
Weight	oz/yd^2	ASTM D 3776	8.3	
Thickness	mils	ASTM D 1777	105	
Grab Strength	lbs	ASTM D 4632	240	210
Grab Elongation	%	ASTM D 4632	>50	50
Tear Strength	lbs	ASTM D 4533	100	85
Mullen Burst	psi	ASTM D 3786	350	320
Puncture Resistance	lbs	ASTM D 4833	115	100
Permittivity	sec^{-1}	ASTM D 4491	1.7	
Water Permeability	cm/sec	ASTM D 4491	0.4	
Water Flow Rate	gpm/ft^2	ASTM D 4491	120	
UV Resistance (500 hrs)	%	ASTM D 4355	>85	
pH			2 - 13	

3. If directed by the **County**, the filter fabric manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service shall be furnished for a minimum of 10 days during initial pipe installation.

4. Filter fabric shall be equal to TenCate Polyfelt TS 700, Trevira Fiber Company 1125, or Supac 7-MP.

2.03 INITIAL BACKFILL

A. Initial backfill material shall be crushed stone as specified for bedding and haunching materials or earth material meeting the requirements of this section.

2.04 FINAL BACKFILL

A. Final backfill material for unpaved areas shall be general excavated earth materials, shall not contain rock larger than two (2) inches at its greatest diameter, cinders, stumps, limbs, man-made wastes, and other unsuitable materials. If materials excavated from the trench are not suitable for use as final backfill material, the **Contractor** shall provide select material conforming to the requirements of this section, including compaction requirements.

B. Final backfill material for paved areas shall be crusher run. The **Contractor** shall install crusher run to the sub-base elevation in paved areas.

2.05 SELECT BACKFILL

Select backfill shall be imported materials that meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.

2.06 CONCRETE

Concrete for bedding, haunching, initial backfill, or encasement shall have a compressive strength of not less than three thousand (3,000) psi, with not less than five and one-half (5½) bags of cement per cubic yard and a slump between three and five (3 and 5) inches. Ready-mixed concrete shall be mixed and transported in accordance with the requirements of ASTM C94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

2.07 FLOWABLE FILL

Flowable fill, where required for trench backfill, shall be submitted for approval and meet the requirements of the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, Section 600 for Excavatable or Non-Excavatable type. http://www.dot.ga.gov/PartnerSmart/Business/Source/specs/ss600.pdf#search=section%20600 The **Contractor** shall receive direction from the **County** on which type of flowable fill shall be used on a case-by-case basis.

1. Flowable fill is a mixture of Portland cement, fly ash, fine aggregate, air entraining admixture, and water. Flowable fill contains low cementitious content for reduced strength development.
2. Ensure flowable fill is manufactured at plants that qualify at approved sources according to the Standard Operating Procedure for Quality Assurance for Ready-Mix Concrete Plants in Georgia.

2.08 GRANULAR MATERIAL

Granular material, where required for trench backfill, shall be sand, river sand, crushed stone or aggregate, pond screenings, crusher run, recycled concrete, or other angular material. Granular material shall meet gradation requirements for Size No. 57 or finer.

2.09 COMPACTION EQUIPMENT

Compaction equipment shall be of suitable type and adequate to obtain the amount of compaction specified. Compaction equipment shall be operated in strict accordance with

the manufacturer's instructions and recommendations and shall be maintained in such condition that it shall deliver the manufacturer's rated compaction effort.

PART 3 - EXECUTION

3.01 PREPARATION OF PIPELINE EASEMENT

A. Preparation of pipeline easement shall be performed in accordance with the requirements of Section 02200 - Earthwork. Where clearing or partial clearing of the easement is necessary, the **Contractor** shall clean the easement prior to the start of trenching. The **Contractor** shall cut trees and brush as near to the surface of the ground as practicable, remove all stumps, and pile for disposal. The **Contractor** shall not permit excavated materials to cover brush or trees prior to disposal.

The **Contractor** shall not remove any trees without approval from the **County**.

B. Trees and shrubs farther than ten (10) feet from pipe centerline shall not be removed unless designated for removal by the **County** and within the easement. The **Contractor** shall protect all other trees and shrubs.

3.02 DISPOSAL OF CLEARED MATERIAL

The **Contractor** shall bear all costs of disposing of trees, stumps, brush, roots, limbs, and other waste materials from the clearing operation. Material shall be disposed of in such a manner as to meet all the requirements of Federal, State, and local regulations regarding health, safety, and public welfare. All cleared material shall be disposed of offsite in an approved location and at the **Contractor's** expense.

3.03 OBSTRUCTIONS

This item refers to obstructions that may be removed and do not require replacement. The **Contractor** shall remove obstructions within the trench area or adjacent thereto such as tree roots, stumps, abandoned piling, concrete structures, logs, and debris of all types without additional compensation. The **County** may make changes in the trench alignment to avoid major obstructions, if such alignment changes can be made within the easement or right-of-way without adversely affecting the intended function of the facility. The **Contractor** shall dispose of obstructions removed from the excavation in accordance with the requirements of this section.

3.04 TRENCH EXCAVATION

A. Topsoil and grass shall be stripped a minimum of six (6) inches over the trench excavation site and stockpiled separately for replacement over the finished grading areas.

B. Trenches shall be excavated to the lines and grades shown on the Plans with the centerlines of the trenches on the centerlines of the pipes and to the dimensions that

provide the proper support and protection of the pipe and other structures and accessories.

C. Trench Width for Pipelines:

1. The sides of all trenches shall be vertical, as much as possible, to a minimum of one (1) foot above the top of the pipe. Unless otherwise indicated on the Plans, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two (2) feet. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.

2. The **Contractor** may, with the **County's** approval, excavate the top portion of the trench to the maximum width within the construction easement or right-of-way that will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees, or private property. Where necessary to protect adjoining structures, roadways, pavement, utilities, trees, or private property, the **Contractor** shall provide sheeting and shoring. The **Contractor** shall use trench boxes to stabilize the trench meeting minimum structural loading. The **Contractor** shall ensure that all shop drawings from the supplier of the trench boxes have been stamped by a Professional Engineer registered in Georgia. The **Contractor** shall also submit to the **County** for approval the sheeting and shoring.

3. Where rock is encountered in trenches, the **Contractor** shall excavate to remove boulders and stones to provide a minimum of six (6) inch clearance between the rock and any part of the pipe or manhole. The maximum allowable width of rock excavation for payment shall be the outer diameter of the pipe bell to be installed plus twenty-four (24) inches.

4. Wherever the prescribed maximum trench width is exceeded, the **Contractor** shall use the next higher Class or Type of bedding and haunching as shown on the Plans for the full trench width as actually cut. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which causes sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the **Contractor's** tamping and compaction equipment, intentional over-excavation due to the size of the **Contractor's** excavation equipment, or other reasons beyond the control of the **County** and the cost is borne by the **Contractor**.

D. Depth:

1. The trenches shall be excavated to the required depth or elevation that allows for the placement of the pipe and bedding to the dimensions shown on the Plans.

2. Where rock is encountered in trenches for pipelines, the **Contractor** shall excavate to the minimum depth that shall provide clearance below the pipe barrel of eight (8) inches for pipe twenty-one (21) inches in diameter and smaller and 12 inches for larger pipe and manholes. The **Contractor** shall

remove boulders and stones to provide a minimum of six (6) inches clearance between the rock and any part of the pipe, manhole, or accessory.

E. Excavated Materials:

1. Excavated materials shall be placed a minimum of two (2) feet from the top edge of the open trench and may be used for backfilling as required. Topsoil shall be carefully separated and lastly placed in its original location.

2. Excavated materials shall not be placed in public roadways. Excavated materials not used or useful as backfill shall be immediately disposed of away from the site of the Work in accordance with the requirements of Section 02200 - Earthwork.

3. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

3.05 SHORING, SHEETING, AND BRACING OF TRENCHES

A. The **Contractor** shall sheet and brace the trench as required by Federal, State, and local laws and regulations. Shoring, sheeting, and bracing shall be designed by a Professional Engineer registered in the State of Georgia. OSHA standards shall be used to prevent caving during excavation in unstable material, or to protect adjacent structures, property, workers, and the public. The **Contractor** shall increase trench widths accordingly by the thickness of the sheeting. The **Contractor** shall maintain sheeting in place until the pipe has been placed and backfilled at the pipe zone. Shoring and sheeting shall be removed, as the backfilling is done, in a manner that shall not damage the pipe or permit voids in the backfill. All sheeting, shoring, and bracing of trenches shall conform to the safety requirements of the Federal, State, or local public agencies having jurisdiction. The most stringent of these requirements shall apply.

B. Sheeting, bracing, and shoring shall be performed in the following instances:

1. Where sloping of the trench walls does not adequately protect persons within the trench from slides or cave-ins.
2. In caving ground.
3. In wet, saturated, flowing, or otherwise unstable materials, the sides of all trenches and excavations shall be adequately sheeted, braced, and shored.
4. Where trenches and other excavations are within ten (10) feet from existing buildings and structures or where necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees, or private properties, which are required to remain, whichever is more stringent.
5. Where necessary to maintain the top of the trench within the available construction easement or right-of-way.

C. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970, as amended.

D. Timber: Timber for shoring, sheeting, or bracing shall be sound, free of large or loose knots, and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.

E. Steel Sheeting and Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth, and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and live loads. Procedures for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The **Contractor** shall provide closure and sealing between sheet piling and existing facilities.

F. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care shall be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield shall be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be "dragged" with the bottom of the shield extending below the top of the pipe.

G. The **Contractor** shall remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. The **Contractor** shall leave sheeting in place when in the opinion of the **County** it cannot be safely removed or is within three (3) feet of an existing structure, utility, or pipeline. The **Contractor** shall cut off any sheeting left in place at least three (3) feet below the surface.

H. Sheet piling within three (3) feet of an existing structure or pipeline shall remain in place, unless otherwise directed by the **County**.

I. If, in the opinion of the **County**, the material furnished for supporting excavation is not of the proper quality or sufficient size, or not properly placed to insure the safety of the Work or of adjacent structures or property, the **Contractor** shall, upon notice by the **County**, forthwith procure and place satisfactory supports, or place said supports in a satisfactory manner and upon his failure so to do, the **County** may order the **Contractor** to stop work until said notice has been complied with and without entitling the **Contractor** to any claim for extra compensation, damage, or delay.

J. When required by the **County**, a shoring plan shall be submitted by the **Contractor** for approval prior to construction of the particular portion of the Work.

K. All supports in excavations shall be withdrawn in stages on both sides of trenches (to prevent lateral movement of the pipe) as the backfilling is being done, except where, and to such extent as the **County** shall order, or where the **County** shall permit the same to be left in place, at the **Contractor's** expense

and upon the **Contractor's** request. The **Contractor** shall cut off any sheeting left in place, at least three (3) feet below finished grade whenever ordered by the **County**.

3.06 TRENCH ROCK EXCAVATION

A. Rock excavation shall be performed in accordance with the requirements of Section 02200 – Earthwork and as directed by the **County**.

B. Definition of Trench Rock: Any material that requires drilling and blasting, and occupies an original volume of at least one (1) cubic yard. Rock shall be considered as material that cannot be removed with a crawler tractor equal to a D-8 Caterpillar, equipped with a single-tooth ripper or by an excavator trackhoe equal to a Caterpillar 225 rated with a ¾-cubic-yard capacity with a bucket curling pullout capacity of 25,000 pounds.

C. Blasting: The **Contractor** shall exhaust other practical means of excavating prior to utilizing blasting as a means of excavation. The **Contractor** shall provide licensed, experienced workmen to perform blasting. The **Contractor** shall conduct blasting operations in accordance with all existing ordinances and regulations and gain all required permits at their cost. The **Contractor** shall protect all buildings and structures from the effects of the blast. The **Contractor** shall repair any resulting damage. If the **Contractor** repeatedly uses excessive blasting charges or blasts in an unsafe or improper manner, the **County** may direct the **Contractor** to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge at the **Contractor**'s expense.

D. Disposal of Rock: The **Contractor** shall dispose of rock, off site, that is surplus or not suitable for use as riprap or backfill in a lawful manner.

E. The **Contractor** shall notify the **County** prior to any blasting. Additionally, the **Contractor** shall notify the **County** and local fire department before any charge is set.

F. The **Contractor** shall employ an independent, qualified specialty subcontractor, approved by the **County**, to: monitor the blasting by use of a seismograph; identify the areas where light charges shall be used; conduct pre-blast and post-blast inspections of structures, including photographs or videos; and maintain a detailed written log.

3.07 DEWATERING EXCAVATIONS

A. Dewatering shall be performed in accordance with the requirements of Section 02140 - Dewatering.

B. The **Contractor** shall dewater excavations continuously to maintain a water level at least two (2) feet below the bottom of the trench.

A. The **Contractor** shall control drainage in the vicinity of excavations so the ground surface is properly pitched to prevent water running into the excavation.

D. The **Contractor** shall maintain sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations. Where pipes cross natural drainage channels, the Work shall be conducted in such a manner that unnecessary damage or delays in the Work shall be prevented. The **Contractor** shall make provisions for the satisfactory disposal of surface water to prevent damage to public or private property.

E. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete, or backfilling.

F. Where dewatering is performed by pumping the water from a sump, crushed stone shall be used as the medium for conducting the water to the sump. Sump depth shall be at least two (2) feet below the bottom of the trench. Pumping equipment shall be of sufficient quantity and/or capacity to maintain the water level in the sump at least two (2) feet below the bottom of the trench. Pumps shall be a type such that intermittent flows can be discharged. A standby pump shall be required in the event the operating pump or pumps clog or otherwise stop operating.

G. The **Contractor** shall dewater trenches by use of a well point system when pumping from sumps does not lower the water level at least 2 feet below the trench bottom. Where soil conditions dictate, the **Contractor** shall construct well points cased in sand wicks. A casing of six (6) to ten (10) inches in diameter shall be jetted into the ground, followed by the installation of the well point, filling the casing with sand, and withdrawing the casing.

3.08 TRENCH FOUNDATION AND STABILIZATION

A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.

B. If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing, and the material at the bottom of the trench will still not adequately support the pipe, the trench shall be determined to be unsuitable and the **Contractor** shall then stabilize the trench by over-excavating the trench bottom and filling it with crushed stone.

C. Where the replacement of unsuitable material with crushed stone does not provide an adequate trench foundation, the trench bottom shall be excavated to a depth of at least 2 feet below the specified trench bottom. The **Contractor** shall place filter fabric in the bottom of the trench and support the fabric along the trench walls until the trench stabilization, bedding, haunching, and pipe have been placed at the proper grade. The ends of the filter fabric shall be overlapped above the pipe.

D. Where trench stabilization is provided, the trench stabilization material shall be compacted to a minimum ninety (90) percent of the maximum dry density, unless shown on the Plans or specified otherwise in these Specifications.

3.09 BEDDING AND HAUNCHING

A. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders, or large dirt clods.

B. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Plans. All bedding shall extend the full width of the trench bottom. The pipe shall be placed and brought to grade by tamping the bedding material or by removal of the excess amount of the bedding material under the pipe. Adjustment to grade and line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint.

C. At each joint, the **Contractor** shall excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.

D. After the pipe section is properly placed, the **Contractor** shall add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked, or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders, or dirt clods.

E. Gravity Sewers and Accessories: The **Contractor** shall lay pipe with Class "B" bedding, unless otherwise shown on the Plans, specified in these Specifications, specified by the manufacturer, or directed by the **County**.

1. Class "A": The **Contractor** shall excavate the bottom of the trench flat at a minimum depth as shown on the Plans, below the bottom of the pipe barrel. The **Contractor** shall lay pipe to line and grade on concrete block. The **Contractor** shall place concrete to the full width of the trench and to a height of one-quarter of the outside diameter of the pipe above the invert.

2. Class "B": The **Contractor** shall excavate the bottom of the trench flat at a minimum depth as shown on the Plans, below the bottom of the pipe barrel. The **Contractor** shall place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.

3. Class "C": The **Contractor** shall excavate the bottom of the trench flat at a minimum depth as shown on the Plans, below the bottom of the pipe barrel. The **Contractor** shall place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to a height of one-quarter the outside diameter of the pipe above the bottom of the pipe barrel.

4. Type 5: The **Contractor** shall excavate the bottom of the trench flat at a minimum depth as shown on the Plans, below the bottom of the pipe barrel. The **Contractor** shall place and compact bedding material to the proper

grade before installing pipe. After the pipe has been brought to the proper grade, haunching material shall be carefully placed by hand and compacted to the top of the pipe.

F. Manholes: The **Contractor** shall excavate to a minimum of twelve (12) inches below the planned elevation of the base of the manhole. The **Contractor** shall place and compact crushed stone bedding material to the required grade before constructing the manhole.

G. Excessive Width and Depth:

1. Gravity Sewers: If the trench is excavated to excess width, the **Contractor** shall provide the bedding class with the next higher bedding factor. Type 5 Bedding may be used in lieu of Class "A" bedding, where Class "A" bedding is necessitated by excessive trench width.

2. If the trench is excavated to excessive depth, the **Contractor** shall provide crushed stone to place the bedding at the proper elevation or grade.

H. Compaction: Bedding and haunching materials under the pipe, manholes, and accessories shall be compacted to a minimum of ninety (90) percent of the maximum dry density, unless shown or specified otherwise in these Specifications.

3.10 INITIAL BACKFILL

A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill, and ensure the uniform distribution of the loads over the top of the pipe.

B. The **Contractor** shall place initial backfill material carefully around the pipe in uniform layers to a depth of at least twelve (12) inches above the pipe barrel. Layer depths shall be a maximum of six (6) inches.

C. The **Contractor** shall backfill on both sides of the pipe simultaneously to prevent side pressures.

D. The **Contractor** shall compact each layer thoroughly with suitable hand tools or tamping equipment.

E. Initial backfill shall be compacted to a minimum ninety (90) percent of the maximum dry density, unless shown or specified otherwise in these Specifications.

3.11 CONCRETE ENCASEMENT FOR PIPELINES

A. Where concrete encasement is shown on the Plans for pipelines, the **Contractor** shall excavate the trench to provide a minimum of twelve (12) inches clearance from the barrel of the pipe. The **Contractor** shall lay the pipe to line and grade on solid concrete blocks or solid bricks. In lieu of bedding, haunching, and initial backfill, the **Contractor** shall place concrete to the full width of the trench and to a height of not less than twelve (12) inches above the pipe barrel. The **Contractor** shall properly brace the pipeline in order to prevent floating of piping during concrete encasement

placement. The **Contractor** shall not backfill the trench for a period of at least twenty-four (24) hours after concrete is placed.

3.12 FINAL BACKFILL

A. The **Contractor** shall backfill carefully to restore the ground surface to its original condition.

B. Except as specified otherwise in this section, the top six (6) inches shall be topsoil obtained as specified in this section.

C. Excavated material that is unsuitable for backfilling shall be disposed of in accordance with the requirements of Section 02200 - Earthwork.

D. If materials excavated from the trench are not suitable for use as backfill materials, the **Contractor** shall provide select backfill material conforming to the requirements of this section.

E. After initial backfill material has been placed and compacted, the **Contractor** shall backfill the trench with final backfill material. The **Contractor** shall place backfill material in uniform layers, compacting each layer thoroughly as follows:

1. In six (6) inch layers, if using light power tamping equipment, such as a "jumping jack"

2. In twelve (12) inch layers, if using heavy tamping equipment, such as hammer with tamping feet

3. In twenty-four (24) inch layers, if using a Hydraram HARDOX-400 compactor.

F. Settlement: If the trench settles, the **Contractor** shall excavate, re-fill, compact, and grade the surface to conform to the adjacent surfaces.

G. Final backfill shall be compacted to a minimum ninety (90) percent of the maximum dry density, unless specified otherwise.

3.13 ADDITIONAL MATERIAL

A. Where final grades above the pre-construction grades are required to maintain minimum cover, additional fill material shall be as shown on the Plans. The **Contractor** shall utilize excess material excavated from the trench, if the material is suitable. If excess excavated materials are not suitable, or if the quantity available is not sufficient, the **Contractor** shall provide additional suitable fill material.

3.14 BACKFILL WITHIN RIGHTS-OF-WAY

A. The **Contractor** shall compact backfill underlying pavements and sidewalks, and backfill under dirt and gravel roads to a minimum ninety-five (95) percent of the maximum dry density.

3.15 BACKFILL WITHIN GEORGIA DOT RIGHTS-OF-WAY

Backfill within the GDOT rights-of-way shall meet the requirements stipulated in the "Utility Accommodation Policy and Standards," published by GDOT.

3.16 FLOWABLE FILL

A. Where flowable fill is required, and approved by the **County**, the **Contractor** shall excavate the trench to provide a minimum of six (6) inches clearance on either side of the pipe barrel. The **Contractor** shall lay the pipe to line and grade on solid concrete blocks or bricks. In lieu of bedding, haunching, and initial backfill, the **Contractor** shall place flowable fill to the full width and depth of the trench.

B. Flowable fill shall be protected from freezing for a period of thirty-six (36) hours after placement. Minimum temperature of flowable fill at point of delivery shall be fifty (50) degrees F.

C. The **Contractor** shall provide steel plates over flowable fill in road locations.

3.17 COMPACTED GRANULAR MATERIAL

Where compacted granular material is required as initial and final backfill material, it shall be placed after bedding and haunching material specified elsewhere has been placed. Compacted granular material shall be compacted to a minimum ninety-five (95) percent of the maximum dry density.

3.18 TESTING AND INSPECTION

A. The soils testing laboratory is responsible for the following:

1. Compaction tests in accordance with the requirements of this section.

2. Field density tests for each two (2) feet of lift, with at least one test site between each pair of manholes, every one hundred (100) feet within road rights-of-way, or more frequently if ordered by the **County**. The **County** will direct where the **Contractor** shall perform density tests along the site of the Work.

3. Inspecting and testing stripped areas, subgrades, and proposed fill materials.

B. The **Contractor's** duties relative to testing shall include the following:

1. Notifying laboratory of conditions requiring testing.

2. Coordinating with laboratory for field-testing.

3. Paying costs for additional testing performed beyond the scope of that required and for re-testing where initial tests reveal non-conformance with specified requirements.

4. Providing excavation as necessary for laboratory personnel to conduct tests at no cost to the **County**

C. Inspection:

1. Earthwork operations, acceptability of excavated materials for bedding or backfill, and placing and compaction of bedding and backfill are subject to inspection by the **County**.

2. Foundations and shallow spread footing foundations shall be inspected by **County** geotechnical personnel, who shall verify suitable bearing and construction.

D. The **Contractor** shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, state, or federal authorities having jurisdiction.

3.19 DISPOSAL OF EXCESS EXCAVATED MATERIAL

The **Contractor** shall dispose of excess excavated material, in accordance with the requirements of Section 02200 - Earthwork. The **Contractor** shall arrange for the disposal of excess materials, and shall bear all costs and expense of disposal.

+++ END OF SECTION 02324 +++

SECTION 02371
RIPRAP

PART 1 - GENERAL

1.01 SCOPE

A. Where shown on the Plans, specified in these Specifications, or directed by the **County**, the **Contractor** shall provide stone, sand-cement bag or grouted stone riprap, including associated earthwork, geotextile filter fabric, crushed stone, filter material, complete and in place. The type of riprap material will be as indicated on the Plans or directed by the **County**.

B. Related Work Specified Elsewhere:

1. Section 01210 - Measurement and Payment
2. Section 02060 - Crushed Stone Aggregate
3. Section 02200 - Earthwork
4. Section 02324 -Trenching and Trench Backfilling
5. Section 02125 -Temporary and Permanent Erosion and Sediment Control

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300. In addition, the following specific information shall be provided:

1. Testing certificates from a qualified testing agency shall be submitted prior to acceptance of the rock source to verify conformity with the requirements of the Plans and these Specifications. The **Contractor** shall, if requested, coordinate inspection of the rock source with the **County**.

1.03 QUALITY ASSURANCE

A. Reference Standards: The **Contractor** shall comply with the applicable provisions and recommendations of the latest editions of the following standards, except as otherwise shown on the Plans or specified in these Specifications.

1. ASTM C88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
2. ASTM C535 - Standard Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
3. AASHTO T85 - Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate.
4. AASHTO T210 - Method of Test for Aggregate Durability Index.
5. AASHTO T134 - Optimum Moisture Content.

6. Georgia Department of Transportation Standard Specifications Construction of Transportation Systems.

PART 2 - PRODUCTS

2.01 ROCK RIPRAP

A. Rock for riprap shall be sound, dense, durable stones, or rock fragments, free from cracks, pyrite intrusions, and other structural defects. Stones that will be used with mortar shall be free from dirt, oil, or other material that might prevent good adhesion with the mortar. Stones with a laminated structure shall be avoided. Field stones shall not be used as a source of rock for riprap. Only rock that has been approved by the **County** shall be used for riprap.

2.02 STONES FOR RIPRAP

A. All stone for riprap shall be sound, durable pieces of quarried stone weighing one hundred and fifty-six (156) pounds per cubic foot or more. The stone shall be angular and random in shape. Rounded boulders or cobbles shall not be used. Flat, slabby, or shaley pieces shall not be acceptable. Stone shall be resistant to weathering and to water action and free from overburden, spoil, and organic material and shall meet the gradation requirements of this Section.

B. Riprap shall be of the type indicated on the Plans and shall conform to the size types as follows:

Type 2: equivalent to GA DOT specification for “Plain Riprap”:

Percent by Weight	Volume (cu.ft.)	Weight (lb.)	Diameter (in.)
65 – 100 %	0.75 – 2.0	125 - 320	15 – 24
10 – 65 %	0.04 – 0.75	7 - 125	5 – 15
0 – 10 %	0.0 – 0.04	0 - 7	0 – 15

Type 3: equivalent to GA DOT specification for “Dumped Riprap – Type 3”:

Percent by Weight	Volume (cu.ft.)	Weight (lb.)	Diameter (in.)
65 – 100 %	0.10 – 1.0	17 – 65	6 – 18
10 – 65 %	0.01 – 0.1	2 – 17	2 – 6
0 – 10 %	0.0 – 0.01	0 - 2	0 – 2

C. Stones shall consist of durable, sound, hard, angular rock meeting the following requirements for durability absorption ratio, soundness test, and abrasion test:

Durability Absorption Ratio	Acceptability
Greater than 23	Passes
10 to 23	Passes only if Durability Index is 52 or greater
Less than 10	Fails
Durability Absorption Ratio =	Durability Index (Coarse) / % absorption + 1

D. The durability index and percent absorption shall be determined by AASHTO T 210 and AASHTO T 85, respectively. The minimum apparent specific gravity of the stones shall be two and one-half (2½) as determined by AASHTO T 85.

E. Stones shall have less than ten (10) percent loss of weight after five (5) cycles, when tested per ASTM C88.

F. Stones shall have a wear not greater than forty (40) percent, when tested per ASTM C535.

G. Control of gradation shall be by visual inspection. The **Contractor** shall furnish a sample of the proposed gradation of at least five (5) tons or ten (10) percent of the total riprap weight, whichever is less. If approved, the sample may be incorporated into the finished riprap at a location where it can be used as a frequent reference for judging the gradation of the remainder of riprap. Any difference of opinion between the **County** and the **Contractor** shall be resolved by checking the gradation of two (2) random truckloads of stones. Arranging for and the costs of mechanical equipment, a sorting site, and labor needed in checking gradation shall be the **Contractor's** responsibility.

H. The acceptability of the stones shall be determined by the **County** prior to final placement.

2.03 SAND-CEMENT BAG RIPRAP

A. Portland Cement shall meet the requirements of State of Georgia Standard Specifications Construction of Transportation Systems, Section 830 - Portland Cement (reference AASHTO M85).

B. Fine Aggregate shall meet the requirements of State of Georgia Standard Specifications Construction of Transportation Systems, Section 801 - Fine Aggregate. The aggregate shall be composed of hard, durable particles, free from injurious amounts of organic impurities. The aggregate shall have no more than twenty (20) percent passing the No. 200 sieve and the material passing the No. 10 sieve shall not be more than seven (7) percent clay.

C. Bags shall be of cotton, burlap, or fiber reinforced paper capable of containing the sand-cement mixture without leakage during handling or placing. Bags

previously used for sugar or any other material which will adversely affect the sand-cement mixture shall not be used. Capacity of bags shall not be less than three - quarters (¾) cubic foot minimum nor more than two (2) cubic feet maximum.

2.04 GEOTEXTILE FABRIC FILTER

A. Geotextile fabric shall meet the requirements of State of Georgia Standard Specifications Construction of Transportation Systems, Section 881 – Fabrics, for woven fabrics, having physical properties as follows:

Tensile Strength – any direction (ASTM D 4634)	200 lbs
Bursting Strength (ASTM D 3786)	500 psi
Elongation Before Breaking (ASTM D 4634)	10 – 35%
Percent Open Area (GDT: 88)	4.0 – 6.0%

B. Fabric shall be TenCate Mirafi Filterweave FW403 or approved equal.

2.05 STONE FILTER MATERIAL

A. Stone Filter material shall be clean and free from organic matter. It shall be crushed rock or gravel, durable, and free from slaking or decomposition under the action of alternate wetting or drying. The material shall be uniformly graded and shall conform to the following gradation (State of Georgia Standard Specifications Construction of Transportation Systems, Section 800 - Coarse Aggregate, No. 467 modified):

Size	Percentage Passing
2 inch	100
1½ inch	95-100
¾ inch	35-70
⅜ inch	10-30
No. 4 Sieve	0-10

PART 3 - EXECUTION

3.01 GENERAL

A. All slopes to be treated with riprap shall be trimmed to the lines and grades indicated on the Plans or as directed by the **County**. Loose material shall be removed or compacted by the methods approved by the **County**.

B. Unless otherwise indicated on the Plans or directed by the **County**, stone riprap shall not be placed on slopes steeper than the natural angle of repose of the riprap.

3.02 SURFACE PREPARATION

A. Surfaces to receive filter materials and riprap, including the toe trench and slope, shall be brought to the line and grade indicated on the Plans and shall be smooth and firm, free of brush, trees, stumps, and other objectionable material. Where filling of depressions is required or a filled bank is constructed, the new material shall be compacted with hand or mechanical tampers to a minimum of eighty-five (85) percent of maximum density.

B. Unless specifically approved by the **County**, riprap shall be placed in dry conditions. The **Contractor** shall remove and exclude all stormwater, groundwater, and creek or stream water from the excavation. Sump pumps and sand bags or portable dams, diversions, or other approved means, shall be used to remove and exclude water and continuously maintain water level below the bottom of the excavation. Water shall be removed and excluded until both geotextile and stone filter material and riprap have been placed. Any water removed from the excavation shall not be discharged into any surface stream or other water body unless such discharge meets water quality standards. Removed water may be disposed on-site by land application using sprinklers in an area designated by the **County** or by discharge into an approved treatment system.

C. Where the **County** approves for the toe trench to be constructed under water, the following construction practices, or approved equivalent practices, shall be observed:

1. The **Contractor** shall use a U.S. Army Corps of Engineers-approved floating silt fence, or alternative approved method, surrounding the construction area to maintain adjacent water turbidity within applicable permit limits.

2. The **Contractor** shall measure the depth below water of the existing stream bed and submerged bank along the entire toe length, using a calibrated surveyor's rod or equivalent tool.

3. The **Contractor** shall then excavate material until the required trench section has been excavated. Confirmation that the required toe trench depth has been achieved shall be established by the **Contractor** through repeated measurement with the surveyor's rod.

4. In areas where the Plans show the use of geotechnical fabric or where directed by the **County**, geotextile fabric shall then be laid, as described in this section, and temporarily held in place until riprap can be positioned to hold the fabric permanently.

5. In areas where the Plans show the use of stone filter material, or where directed by the **County**, stone filter material shall be placed to the specified thickness and leveled to the extent practical, using the surveyor's rod to verify required depth and level.

D. Cleared and excavated materials shall be hauled off site to an appropriate disposal location arranged by the **Contractor** and at its sole expense unless otherwise indicated on the Plans or specified in these Specifications.

E. Riprap installed at the toe of a stream bank below the elevation of the water in a stream to prevent scour from undermining the riprap shall be backfilled and covered with native soil to the original grade. The backfilled native soil shall be compacted with hand or mechanical tampers to a minimum of eighty (80) percent of maximum density.

3.03 CREEK CROSSINGS

A. Riprap shall be installed at all creek and storm drain crossings, at creek entrance into culverts or headwalls, where indicated on the Plans or required by the **County** in accordance with the Plans, Standard Details, or these Specifications. The dimensional width of the riprap material at creek or storm drain crossings shall be equal to the trench width cut to install the pipeline plus six (6) feet or as directed by the **County**. The method of installation shall be in accordance with the requirements of this section.

B. Installation of riprap shall be kept up as closely as possible with the progress of pipe laying so as to perform the work in a uniform workmanlike manner.

3.04 PLACEMENT OF GEOTEXTILE FABRIC

A. The fabric shall be placed with the long dimension running up the slope, with the upstream strip overlapping the downstream strip. The **Contractor** shall use a minimum of two (2) foot overlap for each overlap. The **Contractor** shall use a wider overlap if recommended by the geotextile manufacturer.

B. The fabric shall be placed loosely with sufficient folded or gathered material to prevent stretching and tearing during riprap placement.

C. The fabric shall be anchored into place using securing pins with type and spacing as recommended by the manufacturer. In addition, the fabric shall be secured at the toe and crest of the slope using anchor trenches at least two (2) feet deep. If a stream bank extends sufficiently above a stream such that riprap would not be installed to the top of the bank, then the fabric shall be anchored in a two (2) foot deep trench up-slope from the top of the minimum free-board of one-half (½) foot above the flow resulting from a fifty (50) year, twenty-four (24) hour storm runoff event.

3.05 PLACEMENT OF STONE FILTER MATERIAL

A. Stone filter shall be uniformly placed to a tolerance of plus or minus one-half (½) inch and to a thickness of twelve (12) inches for Type 2 riprap and eight (8) inches for Type 3 riprap.

B. Stone filter material shall be compacted to a minimum relative density of eighty (80) percent.

3.06 CONSTRUCTION METHODS

A. All riprap construction shall begin at the bottom of the slope and progress upward.

B. The **Contractor** shall place riprap using methods and equipment approved by the **County**. The methods and equipment used to place riprap shall be suitable for the class or type of riprap involved. If the finished riprap emplacement installed using the **Contractor's** method is not satisfactory, the **County** reserves the right to have it removed and replaced using hand placement methods and fresh stone.

C. Unless otherwise indicated on the Plans or directed by the **County**, plain rock riprap shall be constructed using a crane and clam-shell or other suitable equipment approved by the **County**. The rock shall be placed as nearly as practicable in final position using powered equipment. If necessary, larger rocks shall be worked up to the surface when the material on the surface does not meet the weight specifications or when the voids next to the foundation material are too large.

D. The quantity of small stones shall be kept as low as possible, sufficient only to fill the voids between the larger stones. Care shall be taken to ensure that small stones are well distributed throughout the mass and not allowed to segregate or form pockets of small stone. All bridging shall be broken down. Large interstices, or open channels, or voids shall be filled by chinking or otherwise manipulating the stones.

E. When riprap is to be built on existing riprap, special care shall be taken to provide positive anchorage of the new riprap to the existing riprap.

F. The finished riprap surface shall in general conform to the slope lines shown on the Plans. No objectionable, hazardous, or unsightly projections above the general plane surface shall be permitted.

G. The main stones shall be thoroughly chinked and filled with the smaller stones by throwing them over the surface in any manner that is practicable for the smaller stones to fill the voids. This work shall continue with the progress of the construction. Tamping of the stones will not be required if the stones have been placed in a reasonable and satisfactory manner.

H. Knapping of the stones will not be required except stone protruding more than four (4) inches above what is considered the normal surface of the stones, in which case these stones shall be broken down to come within four (4) inches of the normal surface.

3.07 SAND-CEMENT BAG RIPRAP

A. Fine aggregate and Portland cement shall be mixed at a maximum ratio of 5:1 by weight. The amount of water added shall be just enough to achieve optimum moisture content of the aggregate and cement, as determined by AASHTO T134.

B. The cement mixture shall obtain a minimum compressive strength of five hundred (500) psi in seven (7) days.

C. The bags shall be uniformly filled and tied in accordance with applicable permits. The bags shall be placed by hand with tied ends all facing the same direction.

D. The bags shall be packed against one another to produce the desired thickness and form a consolidated mass. Bags shall be placed to the elevation specified or indicated on the Plans to a tolerance of plus or minus three (3) inches. After the bags are placed, the riprap structure shall be kept wet by sprinkling or covering with wet material for at least three (3) days. The sand-cement bags shall be protected from stream water or any disturbance during this curing period, and shall not be placed in freezing weather or when conditions are unfavorable for curing.

3.08 GROUTED RIPRAP

A. After the riprap has been placed, the stones shall be thoroughly wetted before grouting. The spaces between the stones shall then be filled with a well-mixed grout composed of one (1) part Portland cement and three (3) parts of sand mixed with sufficient water to achieve a workable consistency. The grout shall be placed beginning at the toe and proceeding up the slope, and shall be finished by sweeping with a stiff bristle broom. After the grouting is completed, the structure shall be kept wet by sprinkling or covering with wet material for at least three (3) days. The grout shall be protected from stream water or any other disturbance during this curing period, and shall not be placed in freezing weather or when conditions are unfavorable.

3.09 CLEANUP

A. After completion of the riprap construction, the **Contractor** shall remove all debris and construction materials and equipment from the construction area and leave the entire construction area clean, neat, and in serviceable condition. The **Contractor** shall restore the construction area to the original or better condition in accordance with the requirements of Section 02920 - Site Restoration.

+++ END OF SECTION 02371 +++

SECTION 02433
STORM DRAINAGE PIPE

PART 1 - GENERAL

1.01 WORK INCLUDED: The work consists of furnishing and installing storm drain pipe to provide cross drainage of storm water underneath roadways.

PART 2 - PRODUCTS

2.01 CORRUGATED ALUMINUM PIPE: Section 840.01 GA D.O.T. Standard Specifications, (latest edition).

2.02 CORRUGATED STEEL PIPE: Section 844.01 GA D.O.T. Standard Specifications, (latest edition) and Standard 1030D.

2.03 REINFORCED CONCRETE PIPE: Section 843.01 GA D.O.T. Standard Specifications, (latest edition).

2.04 FLARED END SECTION: To be of same material as pipe.

PART 3 - EXECUTION

3.01 EXCAVATING, TRENCHING, AND BEDDING FOR PIPE

A. General: Provide excavating, trenching, and bedding for storm drains in accordance with the provisions of Section 02200, and as follows:

B. Movement of construction machinery: Use all means necessary to avoid displacement of, and injury to, the pipe and structures while compacting by rolling or operating equipment parallel with the pipe. Movement of equipment over a culvert or storm drain at any stage of construction is solely at the risk of the **Contractor**.

C. Bedding: Provide a bedding surface for the pipe with a firm foundation of uniform density throughout the entire length of the pipe. Bed pipes carefully in a soil foundation accurately shaped and rounded to conform to the lower 1/4 of the outside perimeter of the circular pipe, or set the pipe in a bed of sand. Tamp bedding when necessary. Provide bell holes and depressions for pipe joints of only the length, depth, and width required for properly making the particular joint.

3.02 PLACING PIPE

A. General:

1. Carefully examine each pipe to placing. Promptly set aside all defective pipe and all damages pipe. Clearly identify all defects. Do not install defective pipe or damaged pipe.

2. Place all pipe to the grades and alignment shown.

3. Do not place pipe in water, nor place pipe when trench or weather is unsuitable for such work.

4. Install flared end section as shown on the drawings.

3.03 PIPE JOINTS

A. Pipe joints shall be made close and even, butting all around.

B. Coupling for corrugated metal pipe shall be either dimpled band or hugger type. Bolts and nuts shall be galvanized steel.

3.04 BACKFILLING

A. Backfill in accordance with the provisions of Section 02200 and as specified herein.

B. Fill material shall be deposited evenly on both sides of the pipe in tamped layers not exceeding 6" in depth until at least three-fourths the depth of the pipe has been reached. For wide trenches tamping shall be done for a distance on each side of the pipe to at least the diameter of the pipe.

END OF SECTION

SECTION 02446

HORIZONTAL DIRECTIONAL DRILLING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Section includes requirements for Horizontal Directional Drilling (HDD) of High Density Polyethylene (HDPE) Pressure Sewer pipe.

1.2 QUALITY ASSURANCE

A. Experience: Actively engaged in horizontal directional drilling for minimum of 3 years.

B. Field supervisory personnel: Experienced in the performance of work and tasks as stated herein for minimum of 3 years.

1.3 SUBMITTALS

A. Submit for information only.
   1. Presentation of similar experience in the last 3 years.
   2. Include, but not limited to, owner name, address, telephone number, contact person, date and duration of work, location, pipe information, and contents handled by pipeline.
   3. Supervisory field personnel and historical information of HDD experience.
      a. At least one field supervisor listed must be at site when HDD operations are in progress.

B. Submit following Section 01300.
   1. Working Drawings and written procedure describing in detail proposed method and entire operation for information only including, but not limited to:
      a. Size, capacity and arrangement of equipment.
      b. Location and size of drilling and receiving pits.
      c. Dewatering and methods of removing spoils material.
      d. Method of installing detection wire and pipe.
      e. Type, location and method of installing locator station.
      f. Method of fusion pipe segment and type of equipment.
      g. Type of cutting head.
      h. Method of monitoring and controlling line and grade.
      i. Detection of surface movement.
      j. Bentonite drilling mud for information only:
         1) Products information, material specifications, and handling procedures.
         2) Material safety data sheet and special precautions required.
         3) Method of mixing and application.

1.4 PROJECT CONDITIONS

A. Complete HDD so as not to interfere with, interrupt, or endanger surface and activity thereon.

B. Follow applicable ordinances, codes, statutes, rules, and regulations of State of Georgia, MSHA, applicable County building codes, and applicable regulations of Federal Government, OSHA 29CFR 1926, and applicable criteria of ANSI A10.16-1995 (R2001), "Safety Requirements for Tunnels, Shafts, and Caissons."

PART 2 – PRODUCTS

2.1 MATERIALS

A. Pipe.
   1. HDPE: See Section 02624.
   2. HDPE Joints:
      a. Butt fusion joining technique for joining pipe segments installed by HDD. See Section 02624.
      b. When joining HDPE pipe at ends of directional drilling runs fusion bond to adjacent pipe section.
         1) Use butt fusion, socket fusion, or electrofusion coupling joining technique: See Section 02624.
      c. Mechanical Couplings are not permitted for joining of directional drilled pipe sections.
   3. Connect to Other Pipe Materials: See Section 02624.

B. Drilling Fluid:
   1. Bentonite drilling mud compatible with environment.
   2. Waste oil or environmentally non-compatible polymers cannot be part of composition.

C. Detection Wire: TW, THW, THWN, or HMWPE insulated copper, 10 gage or thicker wire.

D. Locator Station.
   1. Underground, Flush Mounted:
      a. Tube minimum 15 inches long with minimum inside diameter of 2-1/2-inches made of non-corrosive material, schedule 40 PVC, HDPE, or equal.
      b. Factory attached cast iron or high-impact plastic collar with ribs to prevent rotation when removing locking lid after locator station is set in concrete.
      c. Light blue cast iron or high-impact plastic locking lid that will withstand AASHTO H-20 traffic loads and ultra-violet rays.

d. Mark locking lid to identify pipeline with permanent identification such as P.S. Locator.
e. Terminal block made of high dielectric material which is made of phenolic resin, plastic, micarta, Lexan or Bakelite for each locator station.
   1) Terminal block furnished with two 3/16-inch threaded studs, nuts, and washers made of nickel plated brass.
f. Approved manufacturers:
   1) C.P. Test Services, Inc., Model Mini.
   2) Handley, Industries, Model T2IS2.
   3) Or equal.

2. Manhole Mounted:
   a. Waterproof enclosure made from cast aluminum, galvanized steel, high-impact plastic, Lexan, Gyrlyn, or equal.
   b. Light blue schedule 40 PVC pipe or schedule 40 galvanized steel with outside diameter of at least 3/4-inch to mount enclosure.
   c. Use similar materials for pipe and enclosure to fasten enclosure onto pipe following manufacturer's instructions.
   d. Approved manufacturers:
      1) Cott Manufacturing Company, Model Finklet or Finkplate, 2 leads.
      2) Gerome Manufacturing Company, Inc., Model Testox Series 300, 2 leads.
      3) Or equal.

PART 3 – EXECUTION

3.1 PREPARATION

A. Excavate pits following Working drawings and Section 02200.

B. Provide equipment to guard against electrocution and alarm system on drilling equipment capable of detecting electrical current as it approaches electric lines.

C. Test pit underground utilities crossing before HDD operation following Section 02000.

3.2 OPERATION

A. General.
   1. Determine drilling length and equipment pull strength for type of soil encountered.
   2. Provide method to control line and grade.
      a. Provide and maintain instrumentation that accurately locates pilot hole.
      b. Drill pilot hole along path following Drawings to these tolerances:
         1) Vertical alignment plus or minus 0.5 foot. Vertical path of pilot hole must not establish new high points not shown on Drawings.
         2) Horizontal alignment plus or minus 1.0 foot.
      c. Include electronic monitoring of horizontal and vertical drilling head location. Obtain accuracy range within 1 inch of actual position of pipeline. Record position readings at maximum of 10 foot intervals.

d. At completion of pilot hole drilling, the **Contractor** shall furnish tabulations of horizontal and vertical alignment to the **County**.

3. When water is encountered.
   a. Provide and maintain dewatering system of sufficient capacity to remove water.
   b. Keep excavation free of water until backfill operation is in progress.
   c. Perform dewatering in manner that removal of soils particles are held to minimum.
   d. Dewater into sediment trap following Section 02125.
4. Maintain close observation to detect settlement or displacement of surface and adjacent facilities.
   a. Notify the **County** immediately if settlement or displacement is detected.
   b. Maintain safe conditions and prevent damage.

B. Drilling Operation.
   1. Drilling Fluids.
      a. Maintain drilling fluid in bore hole to increase stability of surrounding soil and reduce drag on pulled pipe.
      b. Dispose of drilling fluid and other spoils at location following laws, ordinances, rules, and regulations of local jurisdiction.
      c. Transport excess fluids and other spoils to disposal site, at no additional cost to the **County**.
      d. Minimize drilling fluid at locations other than entry and exit points. Immediately clean up any drilling fluids that inadvertently surface.
      e. The **Contractor** shall make all arrangements for furnishing water from the nearest hydrant or other suitable source at no additional cost to the **County**.
   2. Pilot Hole Drilling.
      a. Angle entry hole so that curvature of pilot hole does not exceed allowable bending radius of HDPE pipe.
      b. Be able to make a turn of up to 90 degrees and maintain curvature not to exceed allowable bending radius of HDPE pipe.
      c. Alignment Adjustment and Restarts.
         1) Follow pipeline alignment on Drawings within tolerances specified herein. Before adjustments, the **Contractor** shall notify the **County** for approval.
         2) The **Contractor** shall notify the **County** when forward motion of operation is stopped by an obstruction.
            a) The Contractor shall abandon in place with drilling fluid, unless the **County** directs otherwise.
            b) Upon the County's approval, attempt second installation at approved location or excavate at point of difficulty and install HDPE pipe by trench method following Section 02624.
         3) Withdrawals, abandonments, and restarts are at no additional cost to the **County** when HDD is provided as an option of installation of pipe.
         4) Exercise caution including, but not limited to, locating utilities following Section 02000, drilling downholes (test pits) to observe drill stems or reamer assembly to clear other existing utilities at locations following Drawings.

5) The **Contractor** shall keep the number of boring pits to a minimum, no closer than following distances, unless otherwise approved by the **County**.
   a) Equipment must be capable of boring following lengths in a single bore.

Iron Pipe Size (IPS)	Boring Distance (In feet)
1-1/4	400
1-1/2	400
2	350
2-1/2	350
3	300
4	250

3.3 INSTALLATION

A. Installing HDPE Pipe.
   1. Provide a swivel to reaming assembly and pull section of pipe to minimize torsional stress on pull section after drilling pilot hole.
   2. Hold reaming diameter to 1.5 times outside diameter of HDPE pipe being installed.
   3. Protect pull section as it proceeds during pull back so it moves freely and is not damaged.
   4. Pull detection wire along with HDPE pipe. Extend wire into locator station at each end of HDPE pipe.
   5. When connecting to adjacent pulled or non-pulled section of HDPE pipe, allow pull section of pipe to extend past termination point. Make tie-ins the next day after pullback of HDPE pipe.
   6. The **Contractor** shall test pit pipe installation to verify horizontal and vertical alignment as directed by the County.
      a. One test pit for every 500 feet along length of pipeline.
      b. The **County** or its representative may order additional test pit for each test pit that reveals pipeline installation is not in compliance with Contract Documents at no additional cost to the **County**.
   7. The **Contractor** shall replace portions of pipeline not in compliance with Contract Documents as directed by the **County** and at no additional cost to the **County**.

B. Installing Locator Station.
   1. Locator Stations.
      a. At each end of HDPE pipe. Follow Standard Details or Drawings,
      b. Flush mount underground locator: See Standard Details.
      c. When HDPE pipe is connected to another type of pipe material, continue detector wire over connecting pipe, so locator station is installed out of paved area.
      d. In areas scheduled to be improved identify and protect station locations immediately after installation.
         1) Space 3 stakes equally around the station.
         2) Extend at least 4 feet above existing grade.

3) Flag with orange fluorescent wrap within 6 inches from top of stakes.

e. Manhole mounted locator station: See Standard Details.

2. Detection Wire.

a. Install detection wire without splices as shown on Standard Details.

b. Terminate detection wire inside locator box using proper sized crimp type connectors on wire ends.

c. Connect each wire to terminal maintaining at least 18 inches slack in each wire for underground flush mounted locator stations.

d. Neatly coil slack wire in test station below terminal board.

e. Locate wires on top and along HDPE pipe.

f. Allow adequate slack and support to protect wires from damage during backfilling operations.

g. Test each detection wire for continuity after backfill is completed.

1) If test for continuity is negative, the **Contractor** shall repair or replace as directed by the **County**.

2) After continuity is verified, connect each detection wire to terminal block in locator station.

3.4 FIELD QUALITY ASSURANCE

A. Perform field testing of HDPE pipe following Section 02624.

END OF SECTION

SECTION 02448

PILOT TUBE MICROTUNNELING

PART I - GENERAL

1.01 SCOPE

A. Definition: Pilot Tube Microtunneling shall be defined as an alternate microtunneling system for sizes less than eighteen (18) inch nominal internal diameter pipe. This system is a two (2) or three (3) stage system, which allows accurate, trenchless direct jacking of mainline collection sewer pipes. The Pilot Tube Microtunneling boring machine uses a remote controlled laser or theodolite guidance system to maintain specified line and grade, and a jacking system for thrust and mechanical drive that creates torque to both the pilot tube and the augers used for spoil removal.

B. **Contractor** Responsibility

1. The **Contractor** shall examine the geotechnical report and borings and obtain all additional information as required to ensure that the system provided shall be capable of operating successfully given groundwater conditions, soil type, rock profile, potential for obstructions and all geotechnical parameters pertinent to this type of microtunneling. The **Contractor** shall rely upon Geotechnical information provided by the **County** for determination of means and methods selected by **Contractor** for bidding purposes. **Contractor** is responsible for demonstrating if a differing site condition exists.
2. When using this method of construction, the **Contractor** shall be responsible for the orderly and timely progression of Work. If obstructions with a maximum lateral dimension of less than one (1) foot are encountered, the **Contractor** shall be capable of advancing past said obstructions either by this method or by open trench method. No additional compensation shall be provided for such Work.
3. Pipe used on this project within the defined limits of Work for Pilot Tube Microtunneling shall be designed by the **Contractor's** Professional Engineer. See Part II for design criteria. The pipe manufacturer's professional engineer is acceptable.

4. The **Contractor** shall design vertical shafts, excavations and all other features as required to provide the completed pipe installation.

C. Related Work Specified Elsewhere:

1. Section 01210 - Measurement and Payment
2. Section 02140 - Dewatering
3. Section 02449 - Microtunneling Construction

1.02 SUBMITTALS

A. The **County** shall base the review of submitted details and data with consideration of requirements necessary for the completed Work, including utility conflicts, and the possibility of unnecessary delays in the execution of the Work to be constructed under this Contract. The review of the submittals shall be to confirm that the items requested have been considered in developing the design. The **Contractor** is responsible for ensuring the adequacy of the pilot tube microtunneling system. Review and acceptance of the **Contractor** submittals by the **County** shall not be construed in any way as relieving the **Contractor** of his responsibilities under this Contract. Such review by the **County** shall not be construed by the **Contractor** as an endorsement by the **County** that such methods are constructible or will Work for the specific subsurface soils encountered.

B. The **Contractor** shall submit for review a complete Work plan, including drawings showing details of the proposed method of construction. The Plan shall include written descriptions as necessary to clearly indicate the manner in which the sewer installation shall be performed, including the sequence of Work. Show the location of working shafts, including method of excavation, shoring and bracing, and dewatering techniques that are proposed to be used. The following is not intended to limit, but to provide the minimum of details, that shall be included:

1. A quality control plan that includes, at a minimum, how supervision of installation shall be accomplished and procedures for ensuring line and grade requirements are met. Include forms to be used to determine Work progress.

2. Manufacturer's literature describing in detail the microtunneling system to be used. Include the method of controlling line and grade of the Pilot Tube Microtunneling Machine and details of the pipe installation. Provide detailed descriptions of projects on which this system has been successfully used, including the names, addresses, and telephone numbers of Owner's representatives for these projects.

3. Method of spoils removal including surface storage and disposal.

4. Method of controlling groundwater at the shafts.

5. Shaft dimensions, locations, surface construction, profile, depth, and method of excavation; and shoring and bracing methods and details.

6. Shaft backfill material.

7. Safety plan for shafts. Include details for security fences and shaft covers.

8. Pavement removal and replacement plan.

9. Thrust block design. Include materials to be used.

10. Schedule of Work.

11. The manner in which the annular space shall be filled.

12. Submit testing and post installation inspection plans pursuant to Section 02449 - Microtunneling.

13. Manufacturer's literature on type of pipe to be used and type of joints. Pipe submittal shall include: Manufacturer's literature describing the microtunneling pipe, indicating allowable safe jacking loads with the designated safety factor; anticipated jacking loads, including the manner in which the anticipated jacking loads are generated; details of pipe compression rings to safely distribute jacking forces and instructions on storage, handling, transporting, and installation requirements; design calculations prepared by the **Contractor**'s Engineer and stamped by a Professional Engineer registered in the State of Georgia; and verification by the Manufacturer that the pipe complies with the design. The **Contractor** may employ the pipe Manufacturer for pipe design.

14. **Contractor**'s complete Contingency Plan.

15. Miscellaneous materials to be used on the job.

16. Plan for monitoring ground movement.

C. Structural designs and other engineered components shall be signed and sealed by a Professional Engineer registered in the State of Georgia.

D. Experience Record / **Contractor's** Qualifications. Include name and experience record of superintendent, location of prior Work performed including number of feet installed, and pipe size; contact names and telephone numbers of Owner's representatives; and name and experience record of PTMT operator.

E. Such other information as the **County** may request.

1.03 QUALITY ASSURANCE

A. The **Contractor** shall supply all materials and perform all Work in accordance with applicable American Society of Civil Engineers (ASCE), American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), Occupational Safety and Health Administration (OSHA), or other recognized standards. The latest revisions of all standards are applicable.

1.04 WORKFORCE EXPERIENCE

A. Pilot Tube Microtunneling is deemed to be specialty contractor Work. The selected specialty subcontractor shall, as a minimum, meet one of the following criteria:

1. Successfully completed three thousand (3,000) feet or ten (10) drives of pilot tube microtunneling using the type of equipment to be used, or

2. Meet both of the following criteria:

a. Provide a representative of the manufacturer of the pilot tube microtunneling machine being used by the specialty subcontractor whose level of experience in pilot tube microtunneling is acceptable to the **County**; and

b. Provide an operator with a minimum of three thousand (3,000) feet or ten (10) drives of successful pilot tube microtunneling installation using the equipment to be used who shall be in direct supervision of the pilot tube microtunneling operation at all times.

1.05 LIMITS OF WORK

A. Pilot Tube Microtunneling may be used as an alternative means of microtunneling for mainline sewers less than eighteen (18) inches nominal inside diameter (i.e., sewers with inside diameters of eight (8), ten (10), twelve (12), and fifteen (15) inches).

1.06 DESIGN AND PERFORMANCE REQUIREMENTS

A. Pilot Tube Microtunneling Machine - The system utilized shall be either a two (2) phase system or a three (3) phase system as described below and shall consist of, but not be limited to, the major components listed below.

1. Major Components

a. Line and Grade Control System - The control system shall include, but not be limited to, a theodolite, lighted target, camera, and monitor screen.

b. Jacking Frame - The jacking frame shall possess adequate strength to advance the pilot tube, the enlargement casing, and the string of product pipe from the drive shaft to the receiving shaft. The jacking force shall be easily regulated down to the safe working load rating of the pipe. The frame shall develop a uniform distribution of jacking forces on the end of the pipe. The auger motor shall possess adequate torque to steer the pilot tube and adequate torque and speed to effectively auger the excavated material from the face of the bore to the drive shaft.

c. Pilot Tube - The pilot tubes shall be constructed of steel in rigid, but short, sections to accommodate the small drive and receiving shafts. The tubes shall rigidly connect to each other, the steering

tip, and the enlargement casing and have a clear inside diameter large enough to adequately view the lighted target. The tubes shall withstand the torque encountered in the steering process.

d. Enlargement Casing - The enlargement casing shall be constructed of steel to a diameter just larger than the carrier pipe and have a leading connection compatible with the pilot tube. The leading face of the casing shall possess several large openings for the soil to enter as it advances along the proposed alignment. An internal auger chamber shall funnel the excavated material into the temporary full diameter casings of the three-phase process or into the internal auger casings of the two-phase process. Structural members shall connect the leading edge of the casing to the pilot tube connections.

e. Soil Transportation System - The soil transportation system shall consist of an auger train operating inside the full diameter temporary steel casings of the three-phase system or an internal casing and auger train operating inside the carrier pipe of the Two-phase system. The internal casings of the two-phase process shall be manufactured to minimize leakage of the excavated material into the carrier pipe.

f. Soil Removal - A soil removal system shall be provided to safely remove the excavated material from the drive shaft to the surface.

g. Hydraulic Power Unit - The hydraulic power unit shall rest on the surface and be connected to the jacking frame by hoses. The unit shall meet all applicable noise standards.

h. Lubrication System - A lubrication system shall be employed to minimize pipe friction to ensure that pipe can be installed from the drive shaft to the receiving shaft within the safe working load rating of the pipe. The system shall also be required to minimize the torque required to transport the excavated material to the drive shaft.

i. Monitoring equipment shall be provided capable of continuously monitoring:
   i. The jacking pressure and advancement of the boring head.
   ii. Deviation of the pilot tube microtunneling machine.
   iii. Indication of the steering head.

2. Three (3) Phase System

a. Phase 1: A rigid steel pilot tube in approximately three (3) feet lengths shall be installed through the ground from the drive shaft to the receiving shaft by earth displacement with the microtunnel-jacking frame. The alignment of the pilot tube shall be established with a theodolite mounted at the rear of the drive shaft and accurately set to the desired line and grade. The theodolite shall view a lighted target in the lead or steering pilot tube. A camera shall be fitted to the theodolite and shall transmit the image of the crosshair and the target onto a monitor screen to be viewed in the drive shaft by the operator. As the operator advances the pilot tube through the earth, the center of the target will drift from the

crosshair as a result of the biased or slanted leading tip of the pilot tube. The operator shall rotate the pilot tube as required to orient the slanted steering tip toward the crosshair, and continue to advance the pilot tube until it reaches the receiving shaft.

b. Phase 2: An enlargement casing, fitted with a reamer head, with an outside diameter up to one (1) inch larger than the carrier pipe, shall be rigidly connected to the final pilot tube and advanced into the earth behind the pilot tube. An auger shall be used inside the enlargement casing to remove the material being excavated. The auger shall be contained inside the limits of the enlargement casing as it progresses along the proposed alignment. A train of temporary steel casings with an outside diameter very similar to the enlargement casing and used to move the enlargement casing from the drive shaft to the receiving shaft shall be used. The enlargement casing shall cut a borehole from the drive shaft to the receiving shaft and the temporary casings shall case the hole as it is cut. Each temporary casing shall be fitted with an internal auger to transport the excavated material to the drive shaft where it shall be removed from the shaft and disposed of at an approved location. The pilot tubes shall be recovered in the receiving shaft as the temporary casings are installed.

c. Phase 3: The carrier pipe shall then be installed directly behind the temporary casing pipe, section-by-section, with the jacking frame. The casing pipes and augers shall be recovered in the receiving shaft as the carrier pipe is installed.

3. Two (2) Phase System

a. Phase 1: The pilot tube shall be installed in the same manner described above.

b. Phase 2: The enlargement casing shall be installed in the same manner described in Phase 2 of the Three (3) Phase System. Each carrier pipe shall be fitted with an internal protective-casing pipe to house the auger and prevent damage to the carrier pipe. The carrier pipe shall be installed directly behind the enlargement casing with the internal casing rigidly connected to the auger chamber of the enlargement casing. The internal casing shall be manufactured such that the excavated material does not leak excessively into the carrier pipe. The internal casing shall be fitted with a protective shoe to protect the carrier pipe from damage and to support the casing and auger at the centerline of the pipe. The carrier pipe shall be advanced along the proposed alignment with the jacking frame thus progressing the enlargement casing from the drive shaft to the receiving shaft with the pilot tubes being recovered in the receiving shaft. The excavated material shall be funneled into and conveyed through the internal casing to the drive shaft where it shall be removed from the shaft and disposed of at an approved location. Upon reaching the receiving shaft, the enlargement casing shall be removed and the internal casings and augers retracted and recovered at the drive shaft.

B. Drive and Receiving Shafts: Shaft diameters shall be minimized; however, they shall be commensurate with safe working practices. Shafts shall be located at manhole locations and elsewhere as approved by the **County**. The **Contractor** shall provide equipment as required to keep the shafts free of flowing or standing water while in use. The groundwater control system shall not result in a loss of fines for the soil surrounding the shafts. During the design phase, the **Contractor** shall assess if the lowering of the groundwater in the vicinity of the shafts shall have unacceptable impacts to adjacent structures or roadways. If so, the **Contractor** shall be precluded from lowering of the groundwater table, unless mitigating methods are proposed and accepted by the **County**. Groundwater disposal is the responsibility of the **Contractor**. Design and construction technique for drive and receiving shafts shall be the responsibility of the **Contractor**, and shall be in compliance with all applicable requirements. The **County** shall assume no responsibility for shaft design and / or construction. Shaft design shall include all devices required for safe working conditions and shall be in compliance with OSHA and State of Georgia requirements. The **Contractor** shall make provisions to prevent groundwater, if present, from flowing along the pipe into the shaft and prevent pipe lubricant from escaping into the shaft.

C. Grade and Alignment Requirements: Acceptance criteria for the installed sewer pipe shall be plus or minus one (+/- 1) inch from design grade at any location and plus or minus three (+/- 3) inches from design alignment at any location. Multiple deviations from line or grade such as minus one (1) inch from design grade at a downstream manhole to plus one (1) inch at the next upstream manhole shall not be acceptable. To ensure that acceptable grade is achieved, the installed pipe shall be capable of meeting the design flow and velocities for a full pipe condition as specified in Recommended Standards for Wastewater Facilities, 1990 Edition, as prepared as A Report of the Wastewater Committee of the Great Lakes - Upper Mississippi River Board of State Public Health and Environmental Managers. Excessive steering shall be avoided. Steering correction when required shall not exceed one in two-hundred, fifty (1 in 250) inches.

D. Tunneling Overcut: The overcut of the enlargement casing shall be limited to no more than one (1) inch greater than the diameter of the carrier pipe to be installed.

E. Ground Movement

1. The machine shall provide full support to the tunnel without the use of ground stabilization or other ground support techniques to allow the installation of the sewer line.
2. Drive and receiving shafts shall be designed in a manner to preclude settlement of the adjacent areas.
3. Settlement of the ground surface along the centerline of the gravity sewer during and after construction shall not exceed five-tenths (0.5) of an inch.

4. Repair of ground losses and or damage to structures due to ground losses that are a result of the pilot tube microtunneling operation shall be the responsibility of the **Contractor**.
5. Repair of voids created during the pilot tube microtunneling operation shall be the responsibility of the **Contractor**. A plan of repair shall be prepared by the **Contractor** for review and approval by the **County**.
6. Voids greater than five-tenths (0.5) of an inch beneath pavement shall be filled with a soil slurry mix approved by the **County**.

F. Thrust block design including the establishment of allowable thrust load is the responsibility of the **Contractor** and shall provide a minimum factor of safety of three (3). Thrust blocks shall be designed to distribute loads into the ground in a uniform manner and shall not impart excessive loads on the shaft itself or cause the jacking frame to become misaligned. Special requirements to achieve general thrust block requirements shall be the responsibility of the **Contractor**.

PART 2 - PRODUCTS

2.01 PIPE

A. Pipe: The sewer pipe and pipe joints to be used on this project shall be designed and selected by the **Contractor's** Engineer and verified to withstand all loads the pipe shall experience. Pipe selection shall be based on sanitary sewage use, and all loads that shall be induced on the pipe. Pipe selected shall have a factor of safety of three (3). Design of pipes shall include but not be limited to:

1. In-use loads for the project design life, which shall be defined as 100 years. The in-use loads include, but are not limited to: internal operating, transient, and test pressures; soil overburden, surface loads, and external static water head. AASHTO H-20 shall be used for live load in roadway areas.
2. Installation loads include but are not limited to jacking forces, external pressure from groundwater, soil loads, surface loads, and annular space lubrication injection.
3. Drive length, pipe length, pipe mechanical properties, and quality control provided during manufacture of pipe
4. Provisions for protecting the driving end and intermediate points of the pipe

B. Lubricant shall be selected by the **Contractor** to achieve successful installation of the pipe system. All additives used shall meet NSF Standard 060 for Drinking Water Additives.

C. Minimum pipe sizes are shown on the plans: Up-sizing pipe sizes to accommodate the **Contractor**'s operation will be considered by the **County**; however, no increase in pipe sizing is permitted without written approval of **County**. No additional compensation shall be paid to the **Contractor** for such increase of pipe size or any additional Work that might be associated with this up-sizing.

D. Packing rings (cushion and or gasket buffer) shall be as recommended by the pipe manufacturer.

E Pipe material for pilot tube microtunnels shall be as specified in Section 02449 - Microtunneling Construction.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Methods of construction for the shafts, jacking pits, or other components of the construction shall be such as to ensure the safety of the Work, **Contractor**'s employees, the public; and adjacent property, whether public or private. All damage to property shall be restored to conditions equal to or better than conditions existing prior to construction.

B. Selection of an excavation technique, excavation support system, and dewatering system is the **Contractor's** responsibility. The **Contractor** is responsible to ensure all excavations are in compliance with all Federal, State, and Local regulations.

C. All excavations shall be adequately ventilated. Air monitoring of the shafts or pits shall be conducted on a continuous basis.

D. All Work of excavation, shoring and bracing, and tunneling shall be executed so that settlement is minimized.

E. Before beginning construction at any location, the **Contractor** shall adequately protect existing structures, utilities, trees, shrubs, and other permanent objects. The repair of all associated damages or compensation for damages to permanent facilities due to negligence or lack of adequate protection on the part of the **Contractor** shall be at the **Contractor**'s cost and expense, and shall accrue no cost to the **County**.

F. The **Contractor** shall provide surface drainage during the period of construction to protect the Work and to avoid nuisance to adjoining property and to ensure that surface runoff does not enter the drive or receiving shafts.

G. The **Contractor** shall conduct his operations in such a fashion that trucks and other equipment do not create a dirt nuisance in the streets. The **Contractor** shall immediately remove and dispose of any spillage or excess dirt on the roadway.

H. Blasting shall not be permitted.

I. The tunnel machine operator shall be fully trained on other tunneling projects on the use of the machinery proposed for this project, or at all

times be under the direct supervision of a fully trained and designated operator.

J. The machine shall be operated so as to prevent either surface heave or loss of ground during tunneling and shall be steerable to maintain line and grade within the tolerances specified.

K. The thrust reaction backstop shall be properly designed and constructed. The backstop shall be normal to the proposed pipe alignment. The thrust wall shall be designed to support the maximum obtainable jacking pressure developed by the main jacking system and shall include a safety factor. Failure of the thrust block system and any corrective action required shall be the responsibility of the **Contractor**.

L. The pipe shall be jacked in place without damaging the pipe joints or completed pipe section. All pipe damaged during installation, shall be replaced by the **Contractor** at no additional cost to the **County**.

M. All excavated material from the tunnel and shaft construction shall be disposed of away from the construction site. No stockpiling of material on the job-site shall be permitted. Material shall be removed at regular intervals as stated elsewhere in the specifications.

N. The **Contractor** shall monitor all ground movements associated with the Work and maintain these within permissible tolerances. A baseline survey shall be prepared by the **Contractor** prior to undertaking the microtunneling Work.

O. Work hours shall be per the Contract Documents and ordinance unless otherwise approved by the **County**.

3.02 TESTING AND POST-INSTALLATION INSPECTION

See Section 02449 - Microtunneling for testing and post-installation requirements.

END OF SECTION

SECTION 02449

MICROTUNNELING CONSTRUCTION

PART 1 - GENERAL

1.01 SCOPE

A. This section describes microtunneling and modified direct jack methods and minimum construction requirements to properly complete the pipeline as described in this section and/or shown on the Plans including pipe testing and post-installation closed circuit television (CCTV) inspection. The **Contractor** shall furnish and install all materials and equipment, and perform all labor necessary to fulfill the requirements of the Plans and these Specifications.

B. Available information on the geological setting of the Work and available information from the subsurface investigation are described in the Geotechnical Engineering Evaluation.

C. Microtunneling with a pressure balanced slurry machine shall be completed for all pipe sections calling for microtunnels.

D. Pilot-tube microtunneling is permitted for pipe diameters less than eighteen (18) inches nominal internal diameter in accordance with Section 02448 - Pilot Tube Microtunneling.

E. Related Work Specified Elsewhere:

1. Section 01210 - Measurement and Payment
2. Section 02140 - Dewatering
3. Section 02448 - Pilot Tube Microtunneling

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents. In addition, the following specific information shall be provided:

1. The **County** will review submitted plans, details, and data for compliance with the requirements of this section. Such review shall not be construed to relieve the **Contractor** in any way of responsibilities under the Contract. The **Contractor** shall not commence Work on any item requiring a submittal until the submittal has been reviewed and accepted by the **County**.

2. All **Contractor** submittals requiring structural design shall be signed and sealed by a Professional Engineer registered in the State of Georgia.

3. The **Contractor** shall allow thirty (30) working days for review by the **County** considering the complexity of this Work.

4. The **Contractor** shall submit the following items for review and approval by the **County**:

    a. Microtunneling boring machine (MTBM) design drawings and technical specifications, including but not limited to trailing equipment, configuration of the cutterhead, size of overcut, and MTBM manufacturer's operation manual.

    b. Resumes detailing experience and education for the MTBM operators and Project Superintendent.

    c. Pipe lubrication details.

    d. Guidance system, grade, and alignment control details including procedures for surveying, controlling, and checking alignment and grade.

    e. Methods to control, handle, treat, and dispose of slurry/water.

    f. Details of slurry system and soil separation methods including proposed slurry formulations and hydraulic calculations of the system capacity to handle flows at all distances and changes of elevation to and from the MTBM; method and details of spoil surface storage, processing, and disposal.

    g. Details of jacking system, method of operation, and thrust capacity. The **Contractor** shall include calculations of anticipated jacking forces required to advance the pipe. The **Contractor** shall describe procedures to prevent the maximum jacking force from being exceeded.

    h. Details of method proposed to cushion and distribute jacking forces at the pipe joints, including cushion material and compression calculations.

    i. Details of grouting the annulus space after pipe has been installed, including injection pressure and method of controlling grout pressures.

    j. Proposed plans for critical phases of microtunneling and proposed contingency plans for the potential events such as damage to pipeline structural integrity and repair; bentonite or grout spills or blowouts; loss and return to line and grade; and encountering large voids or cavities.

k. Calculations demonstrating that the pipe and pipe joints selected by the **Contractor** can support the external ground loads and construction forces.

l. Calculations demonstrating that the pipe class selected by the **Contractor** can accommodate the **Contractor's** planned means and methods including the anticipated longitudinal loading (jacking forces), static loading from soil and groundwater, and traffic loadings. The design calculations shall be accompanied by a performance affidavit from the manufacturer that the pipe to be supplied is appropriate for this application.

m. Plans for storage and handling of pipe.

n. Procedures for preparing and submitting daily logs of tunneling operations, including field forms, to meet the requirements of this section.

o. A plan for testing and submittal of test results to demonstrate compliance with these Specifications and **Contractor's** design criteria for permanent products, materials, and installation. The plan shall identify applicable standards and procedures for testing and acceptance.

p. Design mixes for concrete and grout.

q. Method of restraining pipes and preventing the opening of pipe joints by hydrostatic pressure, near the shafts after removal of jack load; and also by soil material entering the pipe joints during microtunneling; and preventing closure of the joints.

r. Details to confirm the compatibility of the pipes with the MTBM, and other microtunneling equipment.

s. Plan and procedure for physically and contractually dealing with possible obstructions.

t. Contingency measures of disposing contaminated soil and groundwater if encountered.

u. Inspection plan of post installation of pipe.

v. Damage correction measures, if any, after pipe installation.

w. Breakdown of Work shifts planned, size, and configuration of shifts crews.

5. The **Contractor** shall submit the following items for record purposes only, and will not be subject to approval by the **County**:

a. Protection against improper mechanical and hydraulic equipment operations, and for lifting and hoisting equipment and material.

b. Ventilation and lighting details.

c. Monitoring for hazardous gases.

d. Protection against flooding and means for emergency evacuation.

e. Safety supervision responsibilities. Description of complete safety program.

6. The **Contractor** shall submit to the **County** construction reports for each shift within twenty-four (24) hours of the operations or at least the following.

a. Location of MTBM face by station and progress of tunnel drive during shift.

b. Hours worked per shift, and a description of Work performed.

c. Completed pipe jacking reports to include: continuous position of the cutter head relative to the designed alignment and grade, cutter head rotation and torque, slurry chamber pressure, continuous readings of jacking pressure reported in tons, continuous monitoring of air quality, continuous record of MTBM pitch and roll, and continuous readings of external pressure.

d. Location and brief soil descriptions of significant soil strata.

e. Groundwater control operations.

f. Observation of lost ground or other ground movement. In this instance, the **County** shall be notified immediately.

g. Indications of damaged pipe joint or pipe.

h. Any unusual conditions or events.

i. Operation shutdown periods or other interruptions in the Work, with reasons.

j. Jacking forces.

1.03 QUALITY ASSURANCE

A. The **Contractor** shall supply all materials and perform all Work in accordance with applicable American Society of Civil Engineers (ASCE), American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), Occupational Safety and Health Administration (OSHA), or other recognized standards. Latest revisions of all standards are applicable. If requested by the **County**, the **Contractor** shall submit evidence that the manufacturer has consistently produced products of satisfactory quality and performance over a period of at least two (2) years.

1.04 DEFINITIONS

A. Microtunneling: A remotely-controlled, guided, pipe-jacking process that provides continuous support to the excavation face and does not require personnel entry into the tunnel for normal operations. This excludes guided boring or pilot tube-type equipment.

B. MTBM: A remotely-controlled, steerable, laser-guided microtunnel boring machine consisting of an articulated boring machine shield and a rotating cutting head.

C. Jacking Shaft: Excavation from which MTBM is launched for installation of a pipeline. A thrust wall may be incorporated to spread reaction loads to the ground.

D. Receiving Shaft: Excavation into which the microtunneling equipment is driven and recovered.

E. Slurry: Water, which may contain additives, that is used to transport soils and to provide continuous support to the advancing face.

F. Lubricant: Water combined with additives and applied between the pipe and soil to minimize friction and to fill the annular space.

G. Obstruction: Any object or feature that lies completely or partially within the cross-section of the microtunnel and prevents continued forward progress or causes uncontrollable change in direction beyond specified pipeline and grade tolerance.

H. Drive: The section of pipeline installed by microtunneling methods from a jacking shaft to a receiving shaft.

I. Slurry System: Transportation of excavated material in slurry flow matched to excavation rate. The slurry system balances ground water pressures and separates soil from the slurry at the end of the process. Soil separation methods are not limited to mechanical means. Soil separation method may be chemical in nature.

J. Pipe String: The succession of joined individual pipes being used to advance the excavation equipment.

K. Jacking System: A system of jacks that pushes the pipe string. The extension rate is synchronized with excavation rate of the machine.

L. Intermediate Jacking Station: Hydraulic jacks installed at intermediate locations in the pipe string to allow selective advancement of discrete segments of the total pipe string.

M. Laser: An optical system projecting a beam to a target to provide guidance reference for the excavation.

N. Guidance System: Relates the actual position of the MTBM to a design reference (e.g. by a laser beam transmitted from the jacking shaft along the centerline of the pipe to a target mounted in the shield).

O. Controls: The system which synchronizes excavation, removal of excavated material, and jacking of pipe to maintain overall balance to provide complete and adequate ground support at all times.

P. Overcut: The annular space between the excavated hole and the outside diameter of the jacking pipe.

Q. Compressed Air Construction: Application of compressed air to the pipeline and heading to maintain stability in unstable ground conditions.

R. Modified Direct Jack Method: Similar to an MTBM, but the equipment is of an open face configuration allowing access to the front of the machine for removal of obstructions. In this application, a pressure balance is not maintained using slurry. The operator is positioned inside the boring head. An Akkerman machine model WM 480 falls into this category.

1.05 WORKFORCE EXPERIENCE

A. Microtunneling is deemed to be specialty **Contractor** Work. The Project Superintendent shall have:

1. At least five (5) years of tunneling/pipe jacking experience.

2. Managed at least two (2) microtunneling projects with drive lengths exceeding five hundred (500) feet.

3. Managed at least one (1) microtunneling project with soil conditions similar to this Project, at least twenty (20) feet deep measured at the invert and under a hydrostatic head of at least ten (10) feet, using equipment similar to that intended for use on this Project.

B. The MTBM operators shall have:

1. Successfully operated a MTBM similar to the one selected by the **Contractor** for this Project.

2. At least two thousand (2,000) feet of microtunneling experience within the past five (5) years, of which one thousand (1,000) feet have been for sizes greater than or equal to thirty (30) inches inside diameter.

3. Worked on at least one (1) microtunneling project with soil conditions similar to this Project (generally SM soils, permeable, and saturated). Operated MTBM equipment on a project with depths greater than twenty (20) feet as measured at the invert under a hydrostatic head of at least ten (10) feet using equipment similar to that intended for use on this Project.

4. The modified direct jack operator shall have completed at least one (1) project where the operator is at the machine head and compressed air was applied.

PART 2 - PRODUCTS

2.01 GROUT

A. Grout shall be used for filling the void between the installed pipe and the surrounding ground. Cement shall conform to the requirements of ASTM C150, Type II. Grout shall have a minimum compressive strength of one hundred (100) psi attained within twenty-four (24) hours. The grout shall be fluid enough to inject through the pipe and to fill voids, however, it shall set promptly enough to keep grout flow under control.

2.02 EQUIPMENT

A. Use of experimental equipment is at **Contractor's** risk. Experimental equipment is defined as any equipment that has little or no historical performance data. Experimental equipment use shall require approval by the **County** and have been used on a minimum of three (3) projects of similar magnitude. Approval of such equipment by the **County** does not extend to means, methods, techniques, sequences, or procedures of construction. The **Contractor** has sole responsibility for successful use of the equipment and impact on area utilities or structures.

2.03 MICROTUNNELING PIPE

A. Pipe for microtunneling shall be ductile iron, reinforced concrete pipe (RCP) or vitrified clay pipe (VCP). No other pipe materials are permitted. Ductile iron, RCP, and VCP pipe class for microtunnels shall be as calculated in Article 2.03, Paragraph G of Section 02449, Microtunneling Construction. All materials used in the construction of gravity flow sanitary sewers shall be new, unused, and shall be of the sizes indicated on the Plans.

B. All materials shall be in strict compliance with the required standards and specifications including ASTM, ANSI, and AWWA.

C. At points of the sewer where a change in pipe classification is shown on the Plans, the **Contractor** may begin at the next joint of pipe rather than cutting the pipe and constructing a collar unless there is a change in horizontal or vertical alignment. In the event the pipe is cut, there shall be no torch cutting, only saw cutting shall be allowed.

D. Ductile Iron Pipe and fittings shall conform to the requirements of Section 02537 - Ductile Iron Sanitary Sewer Pipe and Fittings with a polyethylene lining.

1. Interior Lining: Ductile iron pipe and fittings shall be lined with polyethylene as specified below:

   a. Linings shall cover all exposed surfaces of pipe and fittings subject to contact with sewer liquid or gas. The lining of the pipe barrel shall extend from spigot end through the socket to the edge of the gasket sealing area or recess for pipe using push-on gaskets, and to the edge of the gasket seat for mechanical joints. The lining shall also cover the exterior of the spigot end from the end of the pipe to beyond the gasket sealing area. The lining in fittings shall cover the interior surfaces including the socket areas as defined above. All linings shall be hermetically sealed at the ends.

   b. Lining Materials

      (1) Polyethylene lining material for pipe barrel shall conform to the requirements of ASTM D1248, compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during above ground storage. The polyethylene shall be bonded to the interior of the pipe or fitting by heat. Lining material for exterior of spigot and interior of the socket shall be equal to Roskote Mastic B-151 or Madewell 1104 Coal Tar Epoxy. Polyethylene lining system shall be ACIPCO Polybond.

   c. All surfaces to be lined with polyethylene shall be blast cleaned equal to the requirements of SSPC-SP6. All surfaces to be lined with epoxy shall be blasted and cleaned to remove all loose laitance, scale, or other loose material. No lining shall take place over grease, oil, etc., that would be detrimental to the adhesion of the compound to the substrate.

d. Application

(1) Lining of pipe barrel and fittings shall be forty (40) mils nominal thickness; minimum lining thickness shall be thirty (30) mils. Lining thickness for exterior of spigot and interior of socket shall be eight (8) to ten (10) mils.

(2) The lining shall be applied using a centrifugal lance applicator by applicators certified by the lining manufacturer. The workers shall be experienced and competent in the surface preparation, application, and inspection of the lining to be applied. The compound shall not be applied when the substrate temperature is below forty (40) degree F or in adverse atmospheric conditions that will cause detrimental blistering, pinholing, or porosity of the film.

e. All pipe and fitting linings shall be tested for pinholes in accordance with the requirements of ASTM G62, Method B and shall be Holiday free.

f. All pipe linings shall be checked for thickness using a magnetic film thickness gauge.

g. Each pipe joint and fitting shall be marked with the date of application of the lining system and with the numerical sequence of application of that date.

E. Reinforced Concrete Sanitary Sewer Pipe shall conform to the requirements of Section 02536 - Reinforced Concrete Sanitary Sewer Pipe with sulfide resistant additive.

F. Vitrified Clay Pipe shall conform to the requirements of the approved plans and submittal.

G. The **Contractor** shall be responsible for ensuring that the pipe is designed and manufactured to accommodate the **Contractor's** means and methods, static loadings from groundwater and soil, and dynamic loadings from traffic. The **Contractor** shall provide design calculations, sealed by a Professional Engineer licensed in the State of Georgia, and signed off on by the pipe manufacturer supporting the use of the pipe in this application. The design calculations shall be accompanied by a performance affidavit from the manufacturer that the pipe to be supplied is appropriate for this application.

H. Pipe lengths selected shall be compatible with the **Contractor's** selected means and methods and worksite constraints.

I. The pipe used shall be specifically designed for microtunneling or modified direct jack, as applicable, by the pipe manufacturer.

J. Packing:

1. The material used for packing shall be resilient but shall have a low Young's Modulus and a low Poisson's ratio. The packing material shall have, under dry conditions when subjected to the following maximum permitted bearing pressure, a re-assertion after one (1) hour of at least sixty-five (65) percent of the original thickness, and a compression of at least fifty (50) percent of the original thickness.

2. The **Contractor** shall provide independently authenticated test results to demonstrate that the packing complies with the requirements of this section.

3. The material used for packing shall withstand all imposed loadings applied during the installation of all pipes for each completed length of microtunnel without showing signs of deterioration or distress. The packing material shall be cut to the dimensions that ensure that the full bearing width of the joint is protected.

K. Pipe pieces shall be inspected upon delivery to the site of the Work for quality, dimensional consistency, and defects. After installation, the pipe shall be inspected to determine if any damage has occurred.

L. Pipe joint gaskets shall be in accordance with the requirements of this section and designed to produce a watertight seal at the maximum installation and operating pressures with an appropriate factor of safety.

2.04 CASING PIPE

A. All steel used in the manufacture of Permalok steel pipe shall conform to the requirements of ASTM A36 and ASTM A515, grade 60.

B. Pipe class shall be based on **Contractor** calculations using means and methods planned, including the anticipated longitudinal loading (jacking forces), static loading from soil and groundwater, and traffic loadings. The design calculations shall be accompanied by a performance affidavit from the manufacturer that the pipe to be supplied is appropriate for this application.

PART 3 - EXECUTION

3.01 PREPARATION

A. The **Contractor** shall be responsible for means and methods of microtunneling and pipe jacking operations and shall ensure the safety of the Work, the **Contractor's** employees, the public; and adjacent property, whether public or private.

B. The **Contractor** shall execute microtunneling operations so that ground loss at the surface shall not occur. The completed pipe shall have full bearing against earth; no voids or pockets shall be left in any portion of the Work. The **Contractor** shall fill the annular space between the pipe and ground during microtunneling and modified direct jack operations with lubricating material.

C. The **Contractor** shall maintain clean working conditions inside the jacking operation area and remove spoil, debris, equipment, and other material not required for operations.

D. Intermittent entry of personnel shall be permitted for maintenance and removal of equipment provided that appropriate safety precautions and procedures are taken and safety equipment is functional.

E. Shotcrete application in the brick sewers traversed by the pipelines shall be completed prior to microtunnel or modified direct jack installations. Brick sewers shall be periodically inspected during the microtunneling and modified direct jack operations.

3.02 MICROTUNNEL/MODIFED DIRECT JACK PIPE INSTALLATION AND TESTING

A. The **Contractor** shall inspect all pipe prior to lowering it into the drive pit to ensure that no cracked, broken, or otherwise defective materials are being used. The **Contractor** shall use the pipe manufacturer's recommended method for inspection or site of the Work determination for damage. Pipe delivered with visible cracks, scars, chips, or any damage in excess of the limitations specified, shall not be used. Damaged or defective pipe shall be marked as rejected and shall be promptly removed from the site of the Work.

B. The **Contractor** shall use proper tools and equipment to handle pipe. Slings shall be made of rope, nonmetallic webbing, or other materials that shall not damage the pipe. Lifting eyes shall be used only when approved by the pipe manufacturer.

C. The **Contractor** shall clean ends of pipe thoroughly. The **Contractor** shall remove foreign matter and dirt from pipe joints during laying. The **Contractor** shall lubricate joints per manufacturer's recommendations.

D. The **Contractor** shall jack damaged pipe through to the receiving shaft for removal. Other methods of repairing the damaged conduit may be used, as recommended by the manufacturer and approved by the **County**.

E. The **Contractor** shall air-test individual microtunnel and modified direct jack pipe joints using low pressure air methods in compliance with the requirements of ASTM C828.

F. Hydrostatic Testing as an alternate test procedure:

1. The **Contractor** shall make all arrangements for furnishing water from the nearest hydrant or other suitable source for testing purposes. The **Contractor** shall perform the tests and provide all hoses, tank trucks, plugs, and other necessary equipment to conduct the test requirements at the **Contractor's** option.

2. The **Contractor** shall ensure the maximum amount of leakage in pipes and joints shall not exceed the allowable sixteen one-hundredths (0.16) gallons per hour per inch of diameter, per one hundred (100) feet when field-tested by exfiltration methods over a test period or one (1) hour. The hydrostatic head for test purposes shall exceed the maximum estimated groundwater level in the section being tested by at least six (6) feet, and in no case shall be less than six (6) feet above the inside top of the highest section of pipe in the test section, including service connections. In every case, the height of the water table at the time of the test shall be determined by the **Contractor** from existing monitoring wells, exploratory holes, or such other methods approved by the **County**. The **County** shall make the final decisions regarding test height for the water in the pipe section being tested. The length of pipe tested by exfiltration shall be limited so that the pressure on the invert of the lower end of the section shall not exceed thirty (30) feet of water column.

3. The **Contractor** shall choose to fill the pipe test section twenty-four (24) hours or longer, at the **Contractor's** option, prior to time of exfiltration testing and if desired to permit normal absorption of water into the pipe walls to take place.

G. Prior to final acceptance and final manhole-to-manhole inspection of the sewer system by the **County**, the **Contractor** shall flush and clean all parts of the system. The **Contractor** shall remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the sewer system at or near the closest downstream manhole. If necessary, the **Contractor** shall use mechanical rodding or bucketing equipment.

H. Pipe and/or joints failing the test shall be jacked through to the receiving shaft and be removed. Other methods of repairing the damaged conduit may be used, as recommended by the manufacturer and approved by the **County**.

3.03 GROUND WATER CONTROL

A. The **Contractor** shall provide the necessary ground water control measures, to provide safe working conditions, and to prevent excessive inflow of water into the excavation during jacking operations.

3.04 EQUIPMENT

A. No gasoline-powered equipment shall be permitted in the tunneling operation or shafts. Diesel, electrical, or air-powered equipment is acceptable, subject to applicable Federal and State regulations. The **Contractor** shall use diesel engines equipped with scrubbers.

B. Microtunnel Boring Machine/Modified Direct Jack Machine: The **Contractor** shall employ equipment that shall be capable of handling the various anticipated ground conditions. In addition, the MTBM and Modified Direct Jack, as applicable, shall:

1. Be capable of maintaining the tunnel face under wet and adverse soil conditions and preventing loss of ground through the machine. The MTBM shall provide satisfactory support of the excavated face at all times.

2. Be articulated to allow steering.

3. Incorporate a suitable seal between the MTBM and the leading pipe.

4. Provide protection to the electric and hydraulic motors and operating controls against water damage.

5. Use a bidirectional drive on the cutter head wheel, and/or adjustable fins or other means, to control roll.

C. Automated Spoil Transportation: The **Contractor** shall provide a MTBM that includes an automated spoil transportation slurry system that shall balance the soil and ground water pressures by the use of a slurry pressure balance system. The slurry system shall be capable of adjustments required to maintain face stability for the particular soil condition to be encountered on the Project and shall monitor and continuously balance the soil and ground water pressure to prevent loss of slurry or uncontrolled soil and ground water inflow. The **Contractor** shall:

1. Manage the pressure at the excavation face by use of the slurry pumps (which may be of variable speeds), pressure control valves, and a flow meter.

2. Include a slurry bypass unit in the system to allow the direction of flow to be changed and isolated, as necessary.

3. Provide a separation process when using the slurry transportation system. Design the slurry system to provide adequate separation of the spoil from the slurry so that slurry with a sediment content within the limits set by the **Contractor**'s Work Plan can be returned to the cutting face for reuse. Appropriately contain spoil at the site of the Work prior to disposal.

4. Use the type of separation process suited to the size of the microtunnel being constructed, the soil type being excavated, and the Work space available at each Work area for operating the plant.

5. Carefully monitor the composition of the slurry to maintain the slurry weight and viscosity limits defined by the **Contractor's** Work Plan.

D. Pipe Jacking Equipment: The **Contractor** shall provide a MTBM operation that includes a pipe jacking system with the following features:

1. Main jacks mounted in a jacking frame located in the jacking shaft.

2. Jacking system that successively pushes the MTBM along with a string of connected pipes toward a receiving shaft.

3. Sufficient jacking capacity to push the MTBM and the pipe string through the ground.

4. Hydraulic cylinder extension rates that are synchronized with the excavation rate of the MTBM, as determined by the soil conditions.

5. Spreader rings and packing that develops a uniform distribution of jacking forces on the end of the pipe.

6. Capable of providing and maintaining a pipe lubrication system at all times to lower the friction developed on the surface of the pipe during jacking.

E. Remote Control System: The **Contractor** shall provide a MTBM that includes a remote-control system with the following features:

1. Allows for operation of the system without the need for personnel to enter the tunnel.

2. Has a display available to the operator, at an operation console, showing the position of the shield in relation to a design reference together with other information such as face pressure, roll, pitch, complete guidance system, valve positions, thrust force, cutter head torque, rate of advance, and installed length.

3. Integrates the system of excavation and removal of spoil and its simultaneous replacement by pipe. As each pipe section is jacked forward, the control system shall synchronize all of the operational functions of the system including spoils removal, excavation, and jacking needs.

F. Active Direction Control: The **Contractor** shall provide a MTBM that includes an active direction control system with the following features:

1. Controls line and grade by a guidance system.

2. Maintains grade to within ± one and one-half (1.5) inches and line to within ± two (2) inches.

3. Provides active steering information, which shall be monitored and transmitted to the operating console. As a minimum, this information shall include location of the laser beam on the target, location of the cutter head, and predicted cutter head location.

4. Provides positioning and operation information to the operator on the control console.

5. Connects the pipe string in such a manner that the joint-to-joint angle of any two adjacent pipes does not exceed 0.5 degrees.

6. Continuously shows and automatically records the position of the head with respect to the project design line and grade.

G. The **Contractor** shall provide portable testing equipment at the jacking station for carbon monoxide gas, hydrogen sulfide gas, oxygen deficiency, and explosive gases.

H. The **Contractor** shall use electrical systems that are insulated, not permitting any bare wire exposures. All electrical systems utilized on the MTBM shall be equipped with appropriate ground fault systems.

I. The **Contractor** shall ensure all equipment is suitably insulated so as not to exceed the noise limitations stated in the Special Conditions.

J. The **Contractor** shall maintain, in good repair, necessary equipment for pipe excavation, including signal systems, fire extinguishers, safety equipment, and other equipment required by the **Contractor**'s method of construction.

3.05 SHAFTS

A. The **Contractor** shall construct shafts in accordance with the requirements of the approved plans and submittals. If different subcontractors are selected, the **Contractor** shall coordinate schedules, lay down areas, traffic control, muck and groundwater disposal, and other logistical issues so that the Work can be conducted without delays to either of the subcontractors.

3.06 EXCAVATION AND JACKING OF PIPE

A. Microtunnel Excavation:

1. The **Contractor** shall conduct microtunneling operations in accordance with applicable safety rules and regulations and use methods that include due regard for safety of workers and protection for adjacent structures, utilities, and the public.

2. The **Contractor** shall keep microtunnel excavation within the easements and rights-of-way indicated on the Plans, to the lines and grades designated on the Plans.

3. The **Contractor** shall locate equipment powered by combustible fuels at suitable distances from shafts and protect equipment to prevent the possibility of explosion and fire in shafts or the pipe.

4. The **Contractor** shall ensure the rate of advance of the MTBM is matched with the rate of spoil removed to avoid over-excavating.

5. The **Contractor** shall make the excavation of a minimum sufficient size to permit pipe installation by jacking with allowance for injection of the lubricant into the annular space. The overcut shall not exceed one and one-half (1.5) inches. Injection of grout shall be closely monitored in the vicinity of all brick sewer crossings.

B. Pipe Jacking:

For jacking, the **Contractor** shall use pipe that is round with a smooth, even outer surface, and has joints that allow for easy connections between pipes. Pipe ends shall be designed so that jacking loads are evenly distributed around the entire pipe joint and such that point loads shall not occur when the pipe is installed. Pipe used for pipe jacking shall be capable of withstanding all forces that shall be imposed by the process of installation, as well as the final in-place loading conditions. The **Contractor** shall protect the driving ends of the pipe and joints against damage.

1. The **Contractor** shall cushion pipe joints with an approved material between joints or by other methods to transmit the jacking forces without damage to the pipe or pipe joints.

2. The **Contractor** shall use gaskets to make the joints watertight.

3. The **Contractor** shall maintain an envelope of bentonite lubricant, or other similar material, around the exterior of the pipe during the jacking and excavation operation to reduce the exterior friction and possibility of the pipe seizing in place. The **Contractor** shall be cognizant that excessive lubricant application pressure in the vicinity of brick sewers may cause unwanted pipe damage. Water jetting of the ground to advance the pipe is not permitted.

4. If the pipe "freezes" and the **Contractor** is unable to move it again, the **Contractor** may be permitted to construct a recovery access shaft, with the location subject to review by the **County**. The **Contractor** shall be solely responsible for obtaining approvals for such a recovery shaft and shall be solely responsible for costs associated with the location and construction of the shaft and for maintaining traffic and utilities in the area.

5. A lubricant shall be injected from the rear of the MTBM and, if size allows, through ports in the pipes at regular intervals to reduce friction and fill any annular space remaining from the overcut of the cutter head.

6. In the event a section of pipe is damaged during the jacking operation, or joint failure occurs, as evidenced by visible ground water inflow or other observations, the **Contractor** shall use one of the following procedures to correct the damage, as directed by the **County**, at no additional cost to the **County**:

    a. Slightly damaged pipe that passes leakage test and maintains pipe barrel and joint structural integrity, may, if access is possible, be repaired in place with a method approved by the pipe supplier.

    b. Severely damaged pipe, or pipe where joint failure is evident, shall be removed from the excavation by jacking it through the excavation and removing it at receiving shaft.

C. Grouting:

1. The **Contractor** shall completely fill voids outside the limits of the excavation created by caving or collapse of earth cover over the excavation. The **Contractor** shall fill voids with pressure-injected sand cement grout.

2. The **Contractor** shall furnish and operate suitable equipment for any required grouting operations depending on the condition of the application.

3. The **Contractor** shall take care in grouting operations to prevent damage to adjacent utilities or other properties. The **Contractor** shall grout at a pressure that shall not distort or imperil any portion of the Work or existing installation or structures.

4. Immediately after jacking has been completed and the pipe in its final position, any remaining annulus void around the periphery of the installed pipe shall be filled under pressure with grout. The **Contractor** shall inject grout at a sufficient pressure to attain passage along the annulus around the pipe but shall not be greater than fifty (50) psi at the injection nozzle, until no grout is being taken or the volume of grout injected exceeds the designed volume of the annular space by a factor of three (3).

3.07 CONTROL OF LINE AND GRADE

A. Construction Control:

1. The **County** will establish the baseline and benchmarks indicated on the Plans. The **Contractor** shall check baseline and benchmarks at the beginning of the Work and report any errors or discrepancies to the **County**.

2. The **Contractor** shall use the baseline and benchmarks established by the **County** to furnish and provide reference control lines and grades for the pipe construction. The **Contractor** shall establish the exact location of the microtunnel excavation, pipe, and structures.

3. The **Contractor** shall establish and be responsible for accuracy of control for the construction of the entire Project, including access shaft locations, structures, excavation, pipe alignment, and grade.

4. The **Contractor** shall establish control points sufficiently far from the microtunnel and modified direct jack operation not to be affected by ground movement.

5. The **Contractor** shall maintain daily surveying records of alignment and grade. The **Contractor** shall submit three (3) copies of these records to the **County** within twenty-four (24) hours of the operation. The **Contractor**, however, remains fully responsible for the accuracy of its Work and the correction of it, as required.

6. The **Contractor** shall check the primary controls for the MTBM and the modified direct jack machine against an above-ground undisturbed reference at least once each week and once for each two hundred fifty (250) feet of microtunnel constructed, or more often as needed or directed by the **County**.

B. Earth Movement: The **Contractor** shall be responsible for damage due to settlement from any construction-induced activities.

1. The **Contractor** shall take precautions to avoid damage or settlement to buildings, structures, roads, or utilities in close proximity to the Work. The **Contractor** shall use construction methods and equipment that minimize loss of earth at the excavation face and settlement of earth around the pipe.

2. Settlement/heave tolerances of structures shall be estimated and displacement criteria shall be negotiated with respective owners or agencies.

3. In the event any movement of ground is detected, the **County** may order the Work to be stopped and secured. Before proceeding, the **Contractor** shall correct any problems causing or resulting from such movement.

4. The **Contractor** shall be aware that if settlement of the ground surface should occur during construction that will affect the accuracy of the temporary benchmarks established by the **County**, it shall be the **Contractor's** responsibility to detect and report such movement. The locations of the permanent monumentation benchmarks are indicated on the Plans. The **Contractor** may use permanent monumentation benchmarks to verify temporary benchmark accuracy. The **Contractor** shall advise the **County** of any settlement affecting the permanent monumentation benchmarks. Upon completion, the field books pertaining to the monitoring of the permanent monumentation benchmarks shall be submitted to the **County**.

C. Line and Grade:

1. The **Contractor** shall record the exact position of the MTBM and the modified direct jack machine continuously to ensure the alignment is within the specified tolerances. The **Contractor** shall make the survey at the MTBM to allow immediate correction of misalignment before allowable tolerances are exceeded. The microtunnel guidance system may be used. However, the **Contractor** shall select times to measure and record this information after the air temperatures have stabilized throughout the pipe to ensure accurate readings.

2. When the excavation is off line or grade, the **Contractor** shall return to the design line and/or grade at a rate of not more than one (1) inch per twenty-five (25) feet.

3. The **Contractor** shall perform a verification survey of the installed pipe from shaft to shaft after removal of the MTBM and the modified direct jack machine. The **Contractor** shall document measured conformance to design line and grade of the pipe together with locations and deviation (distance and direction) of any out-of-tolerance locations.

4. Acceptance criteria for the pipe shall be ± two (2) inches in horizontal alignment from the theoretical at any point between shafts, including the receiving end, and ± one and one-half (1.5) inches in elevation from the vertical.

5. If allowable tolerances are exceeded, the **Contractor** shall bear full responsibility and expense for correction (redesign, reconstruction, easement acquisition, etc.). If an obstruction is encountered, the **Contractor** shall assume full cost and responsibility for demonstrating that an obstruction exists. If redesign is required, the **Contractor** shall obtain the services of a Professional Engineer registered in the State of Georgia for the redesign. The installed pipe shall be capable of meeting

the design flow and velocities for a full pipe condition. Plans showing the changes shall be submitted to the **County** for review.

6. Pipe installed outside tolerance or which are outside the right-of-way shall be backfilled (grouted) and reconstructed within tolerance, if directed by the **County**.

3.08 DISPOSAL OF SPOIL MATERIAL, CONSTRUCTION WATER, AND SLURRY

A. The **Contractor** shall remove spoil from the site of the Work and dispose of in accordance with the requirements of Section 02200 - Earthwork.

B. Construction water and slurry shall be disposed of in accordance with all applicable Federal, State, and local codes, laws, regulations, ordinances, and Section 02125 – Temporary and Permanent Erosion and Sediment Control

3.09 SETTLEMENT MONITORING

A. The **Contractor** shall perform settlement monitoring for all microtunnels and modified direct jack alignments eighteen (18) inches in diameter or larger.

B. The **Contractor** shall perform microtunneling in a manner that shall minimize the movement of the ground in front of, above, and surrounding the excavation, and minimize subsidence of the surface above and in the vicinity of the excavation.

C. The **Contractor** shall monitor for settlement at one hundred (100) foot intervals along the pipe centerline and a minimum of twenty (20) additional locations at the various microtunnels as defined by the **County**.

D. Daily readings shall be taken on all monitoring points from a period five (5) days before microtunneling is initiated to establish baseline conditions, until the overall construction period is substantially complete. Such monitoring points shall be referenced to temporary benchmarks provided by the **County**. Benchmarks and monitoring points shall be installed in such a manner as to remain in place and undisturbed for the duration of the construction and warranty periods. All survey readings shall be recorded to the nearest one-hundredth (0.01) of a foot.

E. Operations shall be stopped when monitoring points indicate a vertical change in elevation one-half (1/2) inch or more or any surface disruption is observed. The **Contractor** shall propose immediate action for review and approval by the **County** to remedy the problem at no additional cost to the **County**.

3.10 POST-INSTALLATION INSPECTION

A. The **Contractor** shall hire a subcontractor to conduct closed circuit television (CCTV) inspection of the microtunnel and modified direct jack pipe installations in accordance with the requirements of PACP.

B. After microtunneling and modified direct jack installations are complete, the **Contractor** shall complete CCTV inspection of all brick sewer crossings in accordance with the requirements of PACP.

END OF SECTION

SECTION 02485
SEEDING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work covered by this section consists of furnishing all labor, equipment, and material required to place topsoil, seed, commercial fertilizer, agricultural limestone, and mulch material, including seedbed preparation, harrowing, compacting, and other placement operations on graded earthen areas as described herein and/or shown on the Drawings. In general, seeding operations shall be conducted on all newly graded earthen areas not covered by structures, pavement, or sidewalks; all cleared or grubbed areas that are to remain as finish grade surfaces; and on all existing turf areas that are disturbed by construction operations and which are to remain as finish grade surfaces. Areas disturbed by borrow activities shall also be seeded according to these specifications.

B. The work shall include temporary seeding operations to stabilize earthen surfaces during construction or inclement weather and to minimize stream siltation and erosion. Temporary seeding shall be performed on any disturbed area left exposed for a period greater than seven (7) days.

C. Areas disturbed by construction activities, shall be restored to their original conditions with regard to surface grading, drainage, grass type (predominate), or other landscape features.

1.02 RELATED WORK

A. Section 02125 - Temporary and Permanent Erosion and Sediment Control

B. Section 02486 - Sodding

1.03 QUALITY ASSURANCE

A. Prior to seeding operations, the **Contractor** shall furnish to the **County** all labels or certified laboratory reports from an accredited commercial seed laboratory or a state seed laboratory showing the analysis and germination of the seed to be furnished. Acceptance of the seed test reports shall not relieve the **Contractor** of any responsibility or liability for furnishing seed meeting the requirements of this section.

B. Prior to topsoil operations, the **Contractor** shall obtain representative samples and furnish soil test certificates including textural, pH, and organic ignition analysis from the State University Agricultural Extension Services or other certified testing laboratory.

1.04 ALTERNATE METHODS

A. The **Contractor** may propose alternate means and methods to establish a satisfactory coverage of healthy grass of the type required. The **Contractor** shall submit sufficient information to enable the **County** to assess the acceptability of the alternate approach.

PART 2 – PRODUCTS

2.01 TOPSOIL

A. The **Contractor** shall place a minimum of 4 inches of topsoil over all graded earthen areas and over any other areas to be seeded. The quality of topsoil shall be acceptable to the **County**.

B. Topsoil shall be a friable loam containing a large amount of humus and shall be original surface soil of good, rich, uniform quality, free from any material such as hard clods, stiff clay, hardpan, partially disintegrated stone, pebbles larger than ½ inch in diameter, lime, cement, bricks, ashes, cinders, slag, concrete, bitumen or its residue, boards, sticks, chips, or other undesirable material harmful or unnecessary to plant growth. Topsoil shall be reasonably free from perennial weeds and perennial weed seeds, and shall not contain objectionable plant material, toxic amounts of either acid or alkaline elements or vegetable debris undesirable or harmful to plant life.

C. Topsoil shall be natural topsoil without admixture of subsoil material, and shall be classifiable as loam, silt loam, clay loam, sandy loam, or a combination thereof. The pH shall range from five and five tenths to seven (5.5 to 7.0). Topsoil shall contain not less than five (5) percent or more than twenty (20) percent, by weight, of organic matter as determined by loss on ignition of oven-dried samples to sixty-five (65°C) degrees centigrade.

2.02 SEED

A. Seed shall be delivered in new bags or bags that are sound and labeled in accordance with the U. S. Department of Agriculture Federal Seed Act.

B. All seed shall be from the last crop available at time of purchase and shall not be moldy, wet, or otherwise damaged in transit or storage.

C. Seed shall bear the growers analysis testing to ninety-eight (98) percent for purity and ninety (90) percent for germination. At the discretion of the **County**, samples of seed may be taken for check against the grower's analysis.

D. Species, rate of seeding, fertilization, and other requirements shall be as necessary to successfully establish the required stand of grass.

2.03 FERTILIZER AND LIMING MATERIALS

A. Fertilizer and liming materials shall comply with applicable state, local, and federal laws concerned with their production and use.

B. Commercial fertilizer shall be a ready mixed material of grade 18-46-0. Container bags shall have the name and address of the manufacturer, the brand name, net weight, and chemical composition.

C. Agricultural limestone shall be a pulverized limestone having a calcium carbonate content of not less than 85 percent by weight. Agricultural limestone shall be crushed so that at least 85 percent of the material shall pass a No. 10 mesh screen and 50 percent shall pass a No. 40 mesh screen.

2.04 MULCH MATERIAL

A. All mulch materials shall be air dried and reasonably free of noxious weeds and weed seeds or other materials detrimental to plant growth.

B. Mulch shall be composed of wood cellulose fiber, straw, or stalks, as specified herein. Mulch shall be suitable for spreading with standard mulch blowing equipment.

C. Wood-cellulose fiber mulch shall be as manufactured by Weyerhaeuser Company, Conway Corporation, or equal.

D. Straw mulch shall be partially decomposed stalks of wheat, rye, oats, or other approved grain crops.

E. Stalks shall be the partially decomposed, shredded residue of corn, cane, sorghum, or other approved standing field crops.

2.05 MULCH BINDER

A. Mulch on slopes exceeding three to one (3 to 1) ratio shall be held in place by the use of an approved mulch binder. The mulch binder shall be non-toxic to plant life.

B. Emulsified asphalt binder shall be Grade SS-1, ASTM D 977. Cutback asphalt binder shall be Grade RC 70 or RC 250.

2.06 INOCULANTS FOR LEGUMES

A. All leguminous seed shall be inoculated prior to seeding with a standard culture of nitrogen-fixing bacteria that is adapted to the particular seed involved.

2.07 WATER

A. Water shall be clean, clear water free from any objectionable or harmful chemical qualities or organisms and shall be furnished by the **Contractor**.

PART 3 - EXECUTION

3.01 PLACING TOPSOIL

A. Before placing or depositing topsoil upon any areas, all improvement within the area shall be completed.

B. The areas in which topsoil is to be placed or incorporated shall be prepared before securing topsoil for use.

3.02 SEEDBED PREPARATION

A. Before fertilizing and seeding, all topsoil surfaces shall be trimmed and worked to true line free from unsightly variation, bumps, ridges and depressions, and all detrimental material, and roots. All stones larger than two (2) inches in any dimension shall be removed from the soil. All non-residential and residential areas shall be hand raked to remove all detrimental material, roots, and stones

B. No earlier than twenty-four (24) hours before the seed is to be sown, the soil surface to be seeded shall be thoroughly cultivated to a depth of not less than two (2) inches with a weighted disc, tiller, pulvimixer, or other equipment, until the surface is smooth.

C. If the prepared surface becomes eroded because of rain or for any other reason, or becomes crusted before the seed is sown, the surface shall again be placed in a condition suitable for seeding.

D. Ground preparation operations shall be performed only when the ground is in a tillable and workable condition.

3.03 FERTILIZATION AND LIMING

A. Following seedbed preparation, fertilizer shall be applied to all areas to be seeded so as to achieve an application rate 80 pounds per acre.

B. Fertilizer shall be spread evenly over the seedbed and shall be lightly harrowed, raked, or otherwise incorporated into the soil for a depth of ½ inch.

C. Fertilizer need not be incorporated in the soil as specified above when mixed with seed in water and applied with power sprayer equipment. The seed shall not remain in water containing fertilizer for more than thirty (30) minutes when a hydraulic seeder is used.

D. Agricultural limestone shall be thoroughly mixed into the soil at a rate of one to two (1 to 2) tons per acre. The specified rate of application of limestone may be reduced by the **County** if pH tests indicate this to be desirable. It is the responsibility of the **Contractor** to obtain such tests and submit the results to the **County** for adjustment in rates.

E. It is the responsibility of the **Contractor** to make one application of maintenance fertilizer at one-half the original rates applied in early spring following initial establishment of cover.

3.04 SEEDING

A. Seed of the specified group shall be sown as soon as preparation of the seedbed has been completed. No seed shall be sown during high winds, nor until the surface is suitable for working and is in a proper condition. Seeding shall be performed during the periods shown below. Seed mixtures may be sown together provided they are kept in a thoroughly mixed condition during the seeding operation.

B. Seeds shall be uniformly sown by any approved mechanical method to suit the slope and size of the areas to be seeded, preferably with a broadcast type seeder, windmill hand seeder, or approved mechanical power drawn seed drills. Hydroseeding and hydromulching may be used on steep embankments, provided full coverage is obtained. Care shall be taken to adjust the seeder so that the seeding's are at the proper rate before seeding operations are started, and to maintain their adjustment during seeding. Seed in hoppers shall be agitated to present segregation of the various seeds in a seeding mixture.

C. Immediately after sowing, the seeds shall be covered and compacted to a depth of one-eighth to three-eighths (1/8 to 3/8) inch by a cultipacker or suitable roller.

D. Leguminous seeds shall be inoculated prior to seeding with an approved and compatible nitrogen-fixing inoculant in accordance with the manufacturer's mixing instructions.

Seeding Requirements Table

The seed shall be a mixture as shown in the Table below, and shall be applied at the following rates shown:

Seeding Requirements		
Season	Type of Seed	Pounds Per Acre
Jan 1 – May 15	Unhulled Common Bermuda	45
	Kentucky 31 Fescue	300
	Rebel II Supreme	150
May 16 – Sept 1	Hulled Common Bermuda	75
Sept 2 – Dec 31	Unhulled Common Bermuda	45
	Kentucky 31 Fescue	300
	Rebel II Supreme	150

3.05 MULCHING

A. All areas to be seeded shall be uniformly mulched in a continuous blanket immediately after seeding when using Wheat straw at a minimum of two and one-half (2½) tons per acre or equivalent to two to four (2" to 4") inches thickness. The rate of application shall correspond to a depth of at least one inch and not more than one and one half inches, according to the texture and moisture content of the mulch material. It is intended that mulch shall allow some sunlight to penetrate and air to circulate, at the same time shading the ground, reducing erosion and conserving soil moisture. The **Contractor** shall take steps necessary to prevent loss of mulch or bunching of mulch as caused by the wind.

B. Mulch on slopes greater than three to one (3 to 1) ratio shall be held in place by the use of an approved mulch binder. Binder shall be thoroughly mixed and applied with the mulch. Emulsified asphalt or cutback asphalt shall be applied at the approximate rate of five (5) gallons per one thousand (1,000) square feet as required to hold the mulch in place.

C. The **Contractor** shall cover structures, poles, fence, and appurtenances if the mulch binder is applied in such a way that it would come in contact with or discolor the structures.

D. Mulch and binder shall be applied by suitable blowing equipment at closely controlled application rates.

3.06 WATERING

A. **Contractor** shall be responsible for maintaining the proper moisture content of the soil to ensure adequate plant growth until a satisfactory stand is obtained. If necessary, watering shall be performed to maintain adequate water content in the soil. Water shall not be applied when there is danger of freezing. In the event that official watering bans or water restrictions are in effect, the Contract shall comply with applicable guidelines on watering for new grassing.

B. Watering shall be accomplished by hoses, tank truck, or sprinklers in such a way to prevent erosion, excessive runoff, and overwatered spots.

3.07 MAINTENANCE

A. Upon completion of seeding operations, the **Contractor** shall clear the area of all equipment, debris, and excess material and the premises shall be left in a neat and orderly condition.

B. The **Contractor** shall maintain all seeded area without additional payment until final acceptance of the work by the **County**, including all regrading, refertilizing, reliming, reseeding, remulching, and watering required. Seeding work shall be repeated on defective areas until the **County** is satisfied that a satisfactory uniform stand is accomplished Damage resulting from erosion, gulleys, washouts, or other causes shall be repaired at the **Contractor's** expense by filling with topsoil, compacting, and repeating the seeding work.

3.08 VEGETATIVE STABILIZATION SCHEDULE

A. The **Contractor** shall stabilize disturbed areas as construction progresses. The time duration limitations for stabilization of disturbed areas by either temporary mulching (for 7 days or less), temporary grassing, permanent grassing, or permanent sodding shall be as specified in Section 02125 - Temporary and Permanent Erosion and Sediment Control; however, unstabilized areas of the construction corridor shall not exceed one thousand (1,000) linear feet on sanitary sewer sewers or water mains installed with easements and three hundred (300) linear feet for all other projects. Stabilization with permanent vegetation is preferred unless seasonal limitations exist.

+++ END OF SECTION 02485 +++

SECTION 02486
SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Sodding shall consist of establishing certain critical areas with sod as designated on the drawings.

B. Areas disturbed by construction activities shall be restored to their original conditions with regard to surface grading, drainage, grass type (predominate), or other landscape features.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02000 - Site Work
B. Section 02125 - Temporary and Permanent Erosion and Sediment Control
C. Section 02750 - Bypass Pumping
D. Section 02485 - Seeding
E. Erosion and Sediment Control Plan

1.03 ALTERNATE METHODS

A. The **Contractor** may propose alternate means and methods to establish a satisfactory coverage of healthy grass of the type required. The **Contractor** shall submit sufficient information to enable the **County** to assess the acceptability of the alternate approach.

PART 2 - PRODUCTS

2.01 SOD

A. Sod shall consist of a live, dense, well-rooted growth of turf grass species as noted on the Drawings. The sod shall be free from Johnson grass, nut grass and other obnoxious grasses, of suitable character for the purpose intended and for the soil in which it is to be planted. It shall be uninjured at the time of planting.

B. Sod shall be uniform in thickness, having not over two (2) inches or less than one (1) inch of soil.

C. Sod strips shall have a consistent width of twelve or eighteen (12 or 18) inches.

2.02 FERTILIZER

A. Fertilizer (10-10-10) used in connection with sodding, shall contain ten (10) percent nitrogen, ten (10) percent phosphoric acid and ten (10) percent potash. The fertilizer shall be furnished in standard containers with the name, weight, and

guaranteed analysis of the contents clearly marked. The containers shall ensure proper protection in handling and transporting the fertilizer. All commercial fertilizer shall comply with local, state, and federal fertilizer laws.

B. Ammonium nitrate shall be a standard commercial product, shall conform to the requirements for other commercial fertilizers as specified above, and shall have a minimum of thirty-three and one-half (33½) percent nitrogen.

2.03 LIME

A. Agricultural limestone shall contain not less than eighty-five (85) percent of calcium carbonate and magnesium carbonate combined, and shall be crushed so that at least eighty-five (85) percent shall pass the No. 10 mesh sieve and fifty (50) percent shall pass a No. 40 mesh screen.

2.04 WEATHER LIMITATIONS

A. Sod shall be placed only when the soil is moist and favorable to growth. No placement shall occur unless weather and soil conditions are considered favorable for the successful establishment of the particular sod type being placed.

PART 3 - EXECUTION

3.01 SODDING

A. The area to be sodded shall be constructed to the lines and grades indicated on the Drawings and the surface loosened to a depth of not less than three (3) inches with a rake or other device. As applicable, clean, uniform topsoil shall be placed to provide a rich bed for root growth. If necessary, the area shall be sprinkled until saturated at least one (1) inch in depth and kept moist until the sod is placed thereon. Immediately before placing the sod, the fertilizer shall be uniformly applied at the rate of twenty-five (25) pounds of Grade 10-10-10, or equivalent, per one thousand (1,000) square feet. Agricultural limestone shall be applied at the rate of one hundred (100) pounds per one thousand (1,000) square feet.

B. The entire area shall be thoroughly covered with sod. Sod shall be placed on the prepared surface with edges in close contact and, as far as possible, in a position to break joints.

C. Sod shall be maintained moist from time of removal until reset but shall be placed as soon as practicable after removal from place where growing. Immediately after placing, it shall be rolled with a roller or hand tamped to the satisfaction of the **County**.

D. Sod on slopes steeper than three to one (3 to 1) shall be held in place by wooden pins about one (1) inch square and six (6) inches long, driven through the sod into the soil until they are flush with the top of the sod.

3.02 WATERING AND MAINTENANCE

A. Sod shall be watered for a period of two (2) weeks after which ammonium nitrate shall be applied at the rate of three (3) pounds per one thousand (1,000) square feet and the sod given a final watering. Water shall not be applied when there is danger of freezing. In the event that official watering bans or water restrictions are in effect, the **Contractor** shall comply with applicable guidelines on watering for new grassing.

B. The **Contractor** shall not allow any equipment or material to be placed on any planted area and shall erect suitable barricades and guards to prevent his equipment, workers, or the general public from traveling over any area planted with sod.

C. It shall be the obligation of the **Contractor** to secure a satisfactory growth of grass before final acceptance of the project by the **County**

3.02 VEGETATIVE STABLIZATION SCHEDULE

A. The **Contractor** shall stabilize disturbed areas as construction progresses. The time duration limitations for stabilization of disturbed areas by either temporary mulching for seven (7) days or less, temporary grassing, permanent grassing or permanent sodding shall be as specified in Section 02270 - Erosion and Sediment Control; however, unstabilized areas of the construction corridor shall not exceed one thousand (1,000) linear feet on sanitary sewer sewers or water mains installed within easements and three hundred (300) linear feet for all other projects. The permanent vegetative stabilization method is preferred unless seasonal limitations exist.

+++ END OF SECTION 02486 +++

SECTION 02490
TREES, SHRUBS, AND GROUND COVERS

PART I - GENERAL

1.01 SCOPE

A. This Section includes furnishing all equipment, materials, and labor necessary for soil preparation; planting of trees, shrubs, ground cover, or vines as applicable; protection, maintenance, guarantee, and replacement of plants; and all related items necessary to restore the site after the construction work is completed.

B. Products and procedures specified in this section shall apply to the following job-specific conditions:

1. Replacement of trees, shrubs, and ground covers removed or damaged as the result of construction activities. The nature and extent of replacement work shall be as indicated on the Drawings and the cost of such work shall be included in the Contract Price. Such replacement work shall include: the relocation and re-installation of existing plant materials; the replacement of removed plants with new materials, matching quantities, species and arrangement; or, a combination of these options as determined by the scope of the Work.
2. Installation of new materials in accordance with prior agreements made with property owners, as described in the Easement Stipulations. The cost of this work shall be included in the Contract Price.
3. Additional installation of new materials at the direction of the **County** shall be considered extra work and shall be paid for in the Contract.

C. Related Work Specified Elsewhere

1. Section 02200 – Earthwork
2. Section 02125 – Temporary and Permanent Erosion and Sediment Control

1.03 EXISTING CONDITIONS

A. Before commencing any work required by this Section, the **Contractor** shall ascertain the location of all utilities, subsurface drainage, irrigation systems, and underground construction so that proper precautions may be taken not to disturb or damage any subsurface improvements. The **Contractor** shall be held responsible for making, at its own expense, all repairs to damaged utilities, structures and all associated damages resulting from the work.

B. It is not contemplated that planting shall occur where the depth of soil over underground construction or obstructions is insufficient to accommodate the roots or where impervious soil will require drainage. Where such conditions are encountered in excavation of planting areas, other locations for the planting may be designated by the **County**.

C. Removal of underground obstructions, relocation of construction and provision of drainage for planting areas shall be done only as directed by the **County**.

D. If changes in the location of the work or if removal of obstructions involves additional work, the **Contractor** shall proceed in accordance with the "General Conditions" of the Contract for construction.

E. The **Contractor** shall take all necessary precautions during planting operations to avoid damage to existing sidewalks, fencing, paving, curbs, lighting, and other site improvements. Any damage that does occur shall be corrected to the **County's** satisfaction at the **Contractor's** expense.

F. The **Contractor** shall make a dimensional sketch of existing landscaped areas before such areas are disturbed, and shall use said sketch for layout during restoration of these areas. The Preconstruction Video and any still photographs taken prior to construction activities shall also be used to verify the restoration work.

1.04 QUALITY ASSURANCE

A. All planting shall be performed by a company specializing in landscape development construction, particularly soil preparation, lawns, and live plant materials; with at least five years' experience in such work. Evidence of this experience shall be provided, citing similar projects, prior to the initiation of the work.

B. Size, quality, root ball preparation, and grading standards shall conform to the American Association of Nurserymen, Inc., as published in the "American Standard for Nursery Stock: ANSI 260.1, latest approved revision.

C. The **Contractor** shall be responsible for all certificates of inspection of plant materials that may be required by federal, state, or other authorities to accompany shipments of plants. All plants shall be inspected and approved by the **County** before they are planted. Inspection and approval of plants upon delivery shall be for quality, size, and variety only and shall not in any way impair the right of rejection for failure to meet other requirements during progress of the work.

D. Fertilizer shall conform to the local, state, and federal laws applicable to its manufacture and labeling.

1.05 PLANT GUARANTEE AND REPLACEMENT

A. Guarantee - Plants shall be alive, healthy, and vigorous at the end of the Guarantee period. The guarantee period shall be at least one year and shall terminate at the end of the first full growing season. The first full growing season begins on April 1 after planting and ends on November 1.

B. Replacement - Any plant installed under this contract that is dead or not in satisfactory growth, shall be removed from the site; these and any plants missing

due to the **Contractor's** negligence shall be replaced as soon as conditions permit. In case of any question regarding the condition and satisfactory establishment of a rejected plant, the **Contractor** shall notify the **County** immediately in writing, and the **County** shall determine acceptability. All replacement plants shall be guaranteed for the duration of one full growing season as described in Paragraph 1.05A above.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil shall be natural, fertile, agricultural soil, capable of sustaining vigorous plant growth. It shall be of uniform composition without admixture of subsoil. It shall be free of stones (½ inch in diameter or larger), clods of hard earth, live plants, roots, sticks, or other extraneous matter harmful to plant growth.

1. Topsoil shall have an acidity range of ph. 6.0 to 6.5 and shall contain not less than 6 percent organic matter.
2. Topsoil shall be obtained from naturally well drained areas that have never been stripped before.
3. Topsoil shall not be delivered in a frozen or muddy condition.

B. The commercial fertilizer shall be a complete formula, 6-12-12, and shall conform to the applicable state fertilizer laws. It shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer that is caked or otherwise damaged, making it unsuitable for use, shall not be accepted.

C. Pine straw mulch shall be freshly baled straw capable of producing desired results and not contain excessive amounts of pine cones, branches, or forest litter.

D. All mulch shall be clean, and free of weeds, moss, sticks, insects, and debris, and shall be satisfactory to the **County**.

E. Pre-emergent used shall be "Ronstar G" or approved equal.

F. Pine bark shall be good quality commercial stock of one-half to one (1/2" - 1") size pieces (mini-nuggets) or "Nature's Helper".

G. Lime shall be ground limestone with analysis showing not less than eight-five (85) percent total carbonates. Lime shall be delivered in original unopened containers. Any caked or hardened lime shall not be used.

H. Water shall be supplied by the **Contractor**, along with all necessary hose or other watering equipment required for installation and maintenance of plant materials.

I. Herbicide used shall be "Round-up" or Approved Equal.

2.02 PLANT MATERIALS

A. Plant materials used will depend on job-specific conditions, as follows:

1. Trees, shrubs and ground covers removed or damaged as the result of construction activities shall be replaced with new materials of the same size and type, except; mature trees and shrubs shall be replaced in **County** with the following minimum size requirements: trees - two (2) inch caliper; shrubs – two (2) gallon container; or,
2. Plant materials shall be of the size, type and quantity listed in the Easement Stipulations; or,
3. Plant materials will be as directed by the **County**.

B. Plant materials shall comply with State and Federal Laws relating to inspection for diseases and insect infestation.

C. Plant materials shall conform to American Standard Nursery Stock (May 2, 1989, ANSI 260.1-1986). Names shall conform to those given in Standardized Plant Names, 1942 Edition prepared by the American Joint Committee on Horticultural Nomenclature.

D. Plants shall have a habit of growth that is normal for the species and shall be sound, healthy, vigorous, and free from insect pests, plant diseases, and injuries. All plants shall equal or exceed the measurements specified in the plant list before pruning.

E. Plants shall be nursery grown unless otherwise specified.

F. Substitutions will be permitted only upon submittal of proof that the specified plant is not obtainable. A substitute of nearest equivalent size or variety will be used with equitable adjustment of Contract Price when approved in writing by the **County**.

G. Plants designated “B & B” in the plant list shall be adequately balled with firm natural balls of soil sized as set forth in the American Standard for Nursery Stock. Balls shall be firmly wrapped with burlap or similar bio-degradable material and bound with twine, or wire mesh. No balled plant shall be planted if the ball is cracked or broken during shipment or during the planting process.

H. Insofar as is practicable, all plant material shall be planted on the day of delivery. Plants that **County** be planted immediately upon delivery shall be protected from the sun and wind. B & B plants shall be covered with moist soil, mulch, or other acceptable material. B & B plants and container grown plants shall be shaded and well watered. Plants shall not remain unplanted for longer than three days after delivery.

I. Plants shown as container grown in the plant list shall have sufficient root to hold earth intact after removal from containers but without being root-bound.

J. Caliper of tree trunks shall be measured at the chest level of a six (6) tall person for

trees up to and including four (4) inch caliper size.

PART 3 - EXECUTION

3.01 TIME OF PLANTING

A. Planting operations shall be conducted immediately under favorable weather conditions in conformance to the seasonal restrictions as follows:

1. Deciduous Material: September 15 to June 15. Materials shall be in dormant condition if planted after November 1 and prior to April 1. Soil, plant material, and environmental conditions shall be suitable for planting.
2. Evergreen Materials: Spring: March 15 to June 15; Fall: September 1 to November 1.
3. Perennials: Spring: March 30 to June 30; Fall: September 1 to November
4. Annuals: In season.
5. Planting periods may be extended or reduced according to weather and soil conditions at the time. Preparations for planting may begin earlier than specified seasons, if approved.

B. At the option and on the full responsibility of the **Contractor**, planting operations may be conducted under unseasonable conditions without additional compensation; however, prior written approval shall be obtained from the **County** and the guarantee period shall remain as specified in Paragraph 1.05.A herein.

3.02 PRODUCT HANDLING AND STORAGE

A. Balled and burlapped plants shall be dug and prepared for shipment in a manner that shall not damage roots or branches.

B. Protection After Delivery - The balls or roots of plants not planted immediately upon delivery shall be covered with moist soil or mulch, or other protection from drying winds and sun. All plants shall be watered as necessary, until planted. Balled plants shall not be lifted by the trunk of the plant.

3.03 TREES AND SHRUBS

A. Locations for all plants and outlines for planting areas shall be staked on the ground and shall be approved by the **County** before plants are set. Orientation of plants, foliage, and branching shall be approved before installation. Any adjustments in locations and/or outline shall be approved in writing by the **County**.

B. Care shall be exercised to have pits dug and soil prepared prior to moving plants to pits for planting. Circular pits with vertical sides shall be excavated for all plants. Diameter of planting pits shall be twice the diameter of the ball or root spread. The depth of the pits shall be sufficient to accommodate the ball or roots when the plant is set to finished grade allowing for six inches of topsoil in the bottom of the pit. The soil at the bottom of the planting pit shall be loosened to a depth of three inches and mixed with topsoil. Any rock, rubble, hard pan, or other underground

obstruction shall be removed to permit proper installation and drainage. The **Contractor** shall ensure positive drainage away from all planting beds.

C. Soil used in planting shall be a topsoil mixture. One cubic yard of pine bark "Nature's Helper" and twenty pounds of commercial six percent nitrogen-twelve percent phosphorus – twelve percent potassium (6-12-12) fertilizer or bone meal shall be mixed with every six (6) cubic yards of topsoil.

D. Unless otherwise specified, all plants shall be planted in pits, centered, and set at a depth so that the finished grade level shall be the same as that at which the plant was grown.

E. For balled and burlap material, all wire and string binding shall be removed from around the root ball. After placing the plant in the planting pit, the burlap shall be cut away or folded back from the top third of the root ball. If balled plants are wrapped with material that is not biodegradable, then this wrapping material shall be removed once the plant is set in the planting pit. Care shall be taken so not to damage the root system.

F. The pit shall be backfilled with topsoil placed in layers around the roots or ball. Each layer shall be carefully tamped to avoid air pockets. When the hole is approximately two-thirds full, water should be added. After the water has been absorbed, the hole shall be filled with topsoil and tamped lightly to grade.

G. A four (4) inch mound of soil shall be formed around each plant to produce a saucer. On slopes, an adequate shoulder shall be formed on the downhill side to hold water and avoid erosion.

H. Guying and Staking

1. Hose shall be two-ply reinforced hose not less than three-eighths (3/8) inch inside diameter.
2. Wire shall be galvanized pliable, zinc-coated iron not less than No. 16 gage.
3. Turnbuckles shall be galvanized and have a three (3) inch minimum lengthwise opening fitted with screw eyes. Three turnbuckles are required per tree planting.
4. Trees shall be supported immediately after planting. All trees shall be guyed or staked.
5. Guy wires shall consist of two twisted strands of wire encased in hose to prevent direct contact with bark of the tree. Guying shall be spaced equally about each tree. Guy wires shall be placed around the tree trunk or lower branches in a single loop at an angle or about sixty (60) degrees or about two-fifths (2/5s) of the height of the tree. Guy wires shall be fastened to two by two by thirty (2" x 2" x 30") inch wooden stakes driven to approximately six (6) inches above the ground. Guy wires shall be tightened and kept taut by turn-buckles, or other approved methods.
6. Wood stakes to be used shall be uniform two-by-two (2" x 2") inch pressure treated wood with one end sharpened. Stakes shall be not less than six (6')

feet in length.

7. Tree species less than three (3) feet tall shall require slash staking. Wood stakes used shall be uniform two by two (2" x 2") inch pressure treated wood with one end sharpened. Stakes shall not be less than four (4) feet in length.

I. All trees shall be wrapped with standard manufactured tree wrapping paper, brown in color. Tree trunks shall be wrapped spirally overlapping two (2) inches and shall be wound from the ground line to above the lowest main branches. The wrapping shall be securely tied in at least five places, including the top, middle, and bottom, with a jute twine not less than two-ply or other approved bio-degradable material.

J. A four (4) inch layer of pine straw mulch and a pre-emergent such as “Ronstar” or equal shall be applied to all planting bed areas.

K. Plant beds containing ericaceous plants shall be top dressed with ordinary powdered sulfur at the rate of three (3) pints per one hundred (100) square feet of area.

3.04 GROUND COVERS

A. Except as otherwise specified, the **Contractor's** work shall conform to accepted horticultural practices as used in the trade.

B. Planting areas shall be dug and soil for planting ready before plants are delivered.

C. Ground cover beds shall be prepared by thorough loosening of existing subgrade and by placement of a minimum of four (4) inches of approved topsoil to conform to the final grade. Soil used in planting shall be topsoil mixed with one cubic yard of pine bark “Nature's Helper” and twenty pounds of commercial six (6) percent nitrogen-twelve percent phosphorus – twelve percent potassium (6-12-12) fertilizer or bone meal with every six cubic yards of topsoil.

D. Pre-emergence weed control shall be applied in accordance with manufacturer's instructions.

E. All planting beds shall be mulched with a two (2) inch layer of bark mulch prior to planting. Planting holes shall be dug through the mulch. Ensure that roots are surrounded by soil below the mulch.

F. Biodegradable pots shall be crushed and non-biodegradable pots shall be removed prior to planting. The root systems of all potted plants shall be split or crumbled.

3.05 PRUNING AND REPAIR

A. Upon completion of the work under the Contract, all new trees and shrubs shall have been pruned and any injuries repaired. The amount of pruning shall be limited to the minimum necessary to remove dead or injured twigs and branches and to compensate for the loss of roots as a result of transplanting operations. Pruning

shall be done in such a manner as not to change the natural habit or shape of the plant. All cuts shall be made flush, leaving no stubs. On all bruises or scars on the bark and cuts over three-quarter (3/4) inch in diameter, the injured cambium shall be traced back to living tissue and removed; wounds shall be smoothed and shaped so as not to retain water; and the treated area shall be coated with shellac or a commercial tree wound dressing.

3.06 REUSE OF EXISTING PLANT MATERIALS

A. Where shown on the Drawings, or as allowed herein, in-situ plant materials may be removed and re-installed in lieu of replacement with new materials. Such reuse shall conform to the following conditions:

1. In those areas indicated on the Drawings, existing trees and shrubs shall be removed and re-installed. The arrangement or location of the re-installed materials may vary from existing conditions. The **Contractor** shall be responsible for removal, proper handling, temporary storage, re-installation, and maintenance for the existing materials; however, no guarantee of survival is required. The cost of this work shall be included in the Contract Price.
2. If conditions permit, the **Contractor** may, at its own risk, remove and re-install existing trees and shrubs as an alternate to replacement with new materials. The Guarantee and Maintenance requirements shall apply for re-installed existing materials in the same manner as for new materials. The **Contractor** shall obtain written concurrence from the **County** of its intention to reuse existing plant materials prior to the execution of the work.
3. In those areas indicated in the Easement Stipulations or shown on the Drawings, certain existing trees and shrubs may be removed and re-installed by the property owner. The **Contractor** shall provide prior written notification to the property owner (with copy to the **County**) advising of the schedule of construction and the required time frame for removal. If the **Contractor** proceeds with construction without providing the required prior notice, any materials that are damaged or destroyed shall be replaced in **County** and quantity at the expense of the **Contractor**.

B. Trees and shrubs shall be dug with firm natural balls of earth of sufficient size and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant.

C. All plants shall be protected from drying action of the sun and wind during digging and after being dug, while in storage awaiting planting, and while being transplanted. Heel plants or properly protect them with soil, wet peat moss or in a manner acceptable to the **County**.

D. All existing trees and shrubs shall be replanted promptly, preferably within twenty-four (24) hours after removal, but in no case longer than forty-eight (48) hours.

3.07 INSPECTION FOR ACCEPTANCE

A. Upon completion of all planting, and after receipt of written notification, inspection of the landscape work will be made by the **County**. Inspection of the work will be conducted again by the **County** during and at the end of the maintenance period.

3.08 MAINTENANCE

A. Maintenance shall begin immediately after each plant is planted and shall continue until all plants are accepted. Planting shall be protected and maintained by watering, fertilizing, and replanting as necessary, at the **Contractor's** expense, for at least one full growing season following installation beginning April 1 and ending November 1 as specified in Paragraph 1.05.A herein.

+++ END OF SECTION 02490 +++

SECTION 02510
PAVEMENT REPAIRS

PART 1 - GENERAL

1.01 SCOPE

A. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals for installation of all pavement repairs; pavement replacement; surface preparation; asphaltic concrete placement; pavement milling; cleaning and protection and any other similar, incidental, or appurtenant pavement repair operation which may be necessary to properly complete the Work as shown on the drawings and as specified herein.

B. Related Work specified elsewhere:

1. Section 01210 - Measurement and Payment
2. Section 02521 - Concrete sidewalks, curbs and gutters
3. Section 02920 - Site Restoration
4. Section 03300 - Cast-In-Place Concrete

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements within Section 01300 - Submittals of the Contract Documents. In addition, the following specific information shall be provided:

1. The **Contractor** shall submit asphalt mix design to the **County** for approval.

2. Certificates: The **Contractor** shall submit certification of quality control and compliance with the requirements of this section to the **County**. Certificates shall be signed by asphalt and concrete producers and the **Contractor**.

1.03 QUALITY ASSURANCE

A. Reference Standards: The **Contractor** shall comply with the applicable provisions and recommendations of the latest editions of the following standards, except as otherwise shown on the Plans or specified in these Specifications.

1. ASTM C94 - Standard Specification for Ready Mix Concrete.

2. ASTM C33 - Standard Specification for Concrete Aggregates.

3. ASTM C150 - Standard Specification for Portland Cement.

4. ACI 301 - Specifications for Structural Concrete.

5. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

6. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

7. ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

8. ASTM C494 - Chemical Admixtures for Concrete.

9. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

10. ASTM D3371 - Standard Specification for Viscosity-Graded Asphalt Cement for use in Pavement Construction.

11. ASTM D946 - Standard Specification for Penetration Graded Asphalt Cement for use in Pavement Construction.

12. AI (Asphalt Institute) - MS-2- Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.

13. AI (Asphalt Institute) - MS-3- Asphalt Plant Manual.

14. AI (Asphalt Institute) - MS-8- Asphalt Paving Manual.

15. AI (Asphalt Institute) - MS-19 - Basic Asphalt Emulsion Manual.

16. AASHTO M147-65 - Materials for Aggregate and Soil Aggregates.

17. ASTM C-136 - Sieve Analysis of Fine and Coarse Aggregates.

18. Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, latest edition.

B. The **Contractor** shall perform Work in accordance with the requirements of the Georgia Department of Transportation (GDOT) Standard Specifications Construction of Transportation Systems, latest edition.

C. The **Contractor** shall obtain materials from the same source throughout the duration of the paving Work.

D. The **Contractor** shall use only materials which are furnished by a bulk asphalt concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete and shall be a GDOT-approved facility.

1.04 PERFORMANCE REQUIREMENTS

A. The **Contractor** shall comply with the performance standards and requirements established by GDOT.

B. Paving: Pavement shall be designed for movement of trucks up to sixty-thousand (60,000) pounds.

C. General: In addition to other specified conditions, the **Contractor** shall comply with the following minimum requirements:

1. Finished asphaltic concrete courses shall be compacted to the following densities:

a. Asphaltic Concrete Hot Mix Surface Course; Not less than ninety-two (92) percent of theoretical density.

b. Asphaltic Concrete Hot Mix Binder Course: Not less than ninety (90) percent of theoretical density.

2. On the day following placement of asphaltic materials, samples for the determination of in-place density shall be taken from the finished pavement. The **Contractor** shall core the samples at locations and in the manner directed by the **County**. The cuts made in taking such samples shall be repaired by the **Contractor** at no expense to the **County**.

3. The finished surface, when checked with a ten-foot straightedge placed parallel to the centerline, shall show no variation more than one-quarter (¼) inch for base and intermediate courses, and not more than one-eighth ($^1/_8$) inch for surface courses. All testing shall be made in a longitudinal direction at intervals as directed by the **County**. Surface deviations for intermediate courses may be corrected by skin patching, feather edging, or other methods that would provide the required smoothness and maintain quality material. However, surface deviations for surface courses shall be corrected in such a manner as to maintain a quality pavement having the same uniform texture and appearance as the adjoining surface. All corrective work shall be performed at the expense of the **Contractor**.

1.05 REGULATORY REQUIREMENTS

A. The **Contractor** shall conform to applicable code for paving work on public and private properties.

1.06 JOB CONDITIONS

A. Weather Limitations:

1. The **Contractor** shall apply bituminous prime and tack coats only when the ambient temperature in the shade has been at least forty (40) degrees F.

2. The **Contractor** shall not conduct paving operations when the surface is wet, frozen, or contains excess moisture that would prevent uniform distribution and required penetration.

3. The **Contractor** shall construct asphaltic courses only when atmospheric temperature in the shade is above thirty-five (35) degrees F, when the underlying base is dry and when weather is not rainy.

4. The **Contractor** shall place base course when air temperature is above thirty-five (35) degrees F and rising. The **Contractor** shall not place base course on a frozen or muddy subgrade.

B. The **Contractor** shall establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.

C. Traffic Control:

1. The **Contractor** shall maintain vehicular and pedestrian traffic during paving operations, as required for other construction activities.

2. In addition, the **Contractor** shall provide flagmen, barricades, and warning signs for the safe and expeditious movement of traffic through construction zones within public rights-of-way in accordance with the requirements of Section 01550 - Traffic Regulation.

1.07 TEMPORARY ROADWAY PAVING REPAIRS

A. Temporary cold or permanent hot asphalt patching will be required for both transverse and longitudinal roadway cuts upon completing backfilling requirements at the end of each day's work if the road is to be opened for local traffic while work has stopped.

B. It shall be the **Contractor's** responsibility to maintain the temporary paving in such condition as to prevent hindrance or hazard to traffic. When final paving is undertaken the temporary surfacing materials shall be removed to accommodate final paving of types and thicknesses as specified in this section, the edges of the existing paving shall be neatly and uniformly trimmed, and the permanent pavement shall be placed.

C. Steel Plate Bridging:

1. At the **County's** discretion, steel plate bridging may be used. The **Contractor** shall adhere to the following chart with respect to minimum plate size and thickness.

Trench Width	Minimum Plate Thickness
10" (0.25 m)	½" (13 mm)
1'-11" (0.58 m)	¾" (19 mm)
2'-7" (0.80 m)	7/8" (22 mm)
3'-5" (1.04 m)	1" (25 mm)
5'-3" (1.60 m)	1 ¼" (32 mm)
*For trench widths greater than 5' 3", the **County** will determine the plate thickness.	

2. Steel plates used for bridging shall extend a minimum of twelve (12) inches beyond all edges of the trench.

3. For traffic speeds less than forty-five (45) mph, the surrounding pavement shall be cold planed to a depth equal to that of the steel plate selected.

4. For traffic speeds greater than forty-five (45) mph, approach plate(s) and ending plate (if longitudinal placement) shall be attached to the roadway by a minimum of two (2) dowels pre-drilled into the corners of the plate and drilled two (2) inches into the pavement. Subsequent plates shall be butted to each other. Fine graded asphalt concrete shall be compacted to form ramps, maximum slope eight and one-half (8½) percent with a minimum twelve (12) inches taper to cover all edges of the steel plates. When steel plates are removed, the dowel holes in the pavement shall be backfilled with either graded fines of either asphalt concrete mix, concrete slurry, or an equivalent slurry that is satisfactory to the **County**.

5. Steel plates shall not be left on the road in any one location for more than fourteen (14) days.

D. Graded Aggregate Base:

1. Temporary patch paving using graded aggregate base shall be placed only as approved and directed by the **County**. All compacted material shall conform closely enough to the existing road surface so as to permit safe travel.

2. Graded aggregate may consist of gravel, air cooled blast furnace slag, crushed stone, or synthetic aggregate having hard, strong, durable pieces free of adherent coatings and shall be approved for use by the **County**.

1.08 SOURCE QUALITY CONTROL

A. The **Contractor** shall submit proposed mix design of each class of mix to the **County** for review prior to commencement of the Work.

B. The **County's** independent testing laboratory shall test samples in accordance with TAI MS.

1.09 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed in accordance with the requirements of the General Requirements.

B. The **County's** independent testing laboratory shall take samples and perform tests in accordance with the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, latest edition.

1.10 PROTECTION

A. Immediately after placement, the **Contractor** shall protect pavement from mechanical injury for seven (7) days.

PART 2 - PRODUCTS

2.01 FLEXIBLE PAVEMENT

A. Aggregates for asphaltic concrete shall comply with the applicable requirements of the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, latest edition.

B. Asphaltic cement for asphaltic concrete shall comply with the applicable requirements of the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, latest edition.

C. Bituminous prime coat shall comply with the applicable requirements of the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, latest edition.

D. Bituminous tack coat shall comply with the applicable requirements of the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, latest edition.

E. Hot Mix asphaltic concrete construction shall comply with the applicable requirements of the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, latest edition.

2.02 RIGID PAVEMENT

A. Concrete and reinforcing bars (where required) for rigid pavement shall conform to the requirements of Section 03200 - Concrete Reinforcement and Section 03300 - Cast-In-Place Concrete. Concrete for pavement shall be Class A.

2.03 CURB AND GUTTER

A. Concrete for curb, curb and gutter, or valley gutter shall be Class A. Concrete shall conform to the requirements of Section 03300 - Cast-In-Place Concrete.

2.04 SIDEWALKS

A. Concrete for sidewalks shall be Class A conforming to the requirements of Section 03300 - Cast-In-Place Concrete.

2.05 DRIVEWAYS

A. Concrete for driveways shall be Class A conforming to the requirements of Section 03300 - Cast-In-Place Concrete.

2.06 STANDARD GRANITE CURB, GRADE B

A. Curbs shall be furnished in standard lengths of eight (8) feet in so far as possible employing shorter lengths where required such that the minimum length employed shall not be less than four (4) feet long. Curb sections shall have a split face and split top. Each joint shall have an unreinforced concrete footing as specified in the Detail Drawings. On wheel chair ramps and driveways, the granite curb shall continue through depressed sections of these elements as shown in the Detail Drawings. On curve section of roadway, the granite curb shall be split or cut on the curve.

2.07 SPECIALTY BRICK PAVER REPLACEMENT

A. The **Contractor** shall verify the size, type, color, and pattern of the existing specialty brick pavement surface prior to removal. The **Contractor** shall submit to the **County** for review the proposed replacement brick paver material and installation information. Materials shall conform to the existing installation for pattern, color, and size.

2.08 SPECIAL BRICK SIDEWALK REPLACEMENT

A. All brick shall be solid pavers conforming to the requirements of the GDOT Standard Specifications Construction of Transportation Systems, Latest Edition. The **Contractor** shall submit to the **County** for review on the brick to be used to replace brick sidewalks within the Project area. Materials shall conform to the existing installation for pattern, color, and size.

2.09 STAMPED HEXAGONAL CONCRETE PAVERS

A. Where existing, hexagonal concrete pavers shall be removed to allow pipe installation, the **Contractor** may replace them with poured-in-place concrete sidewalk with stamped paver pattern as shown in the Standard Details.

2.10 PAVEMENT MARKINGS

A. This work shall consist of furnishing and applying thermoplastic reflectorized pavement marking compound that is extruded or sprayed on the pavement by mechanical means and which, upon cooling to pavement temperature, produces a reflectorized pavement marking.

B. Pavement markings shall be placed to reconstitute the markings that were existing before the pavement was milled for resurfacing. All final markings shall meet the requirements of the Manual of Uniform Traffic Control Devices (MUTCD). If any existing markings did not meet the MUTCD requirements or were absent, the **Contractor** shall nevertheless upgrade the markings at these locations to meet the MUTCD requirements. Thermoplastic traffic stripe shall consist of solid or broken (skip) lines, words and/or symbols of the type and color as shown in the MUTCD Manual. Short lines such as crosswalks, stop bars, arrows, symbols, and crosshatching shall be extruded. All other lines shall be sprayed.

C. Materials shall meet the requirements of GDOT Standard Specifications Construction of Transportation Systems, latest edition, Section 653.02.

D. Pavement markings shall include, but not be limited to, the following:

1. Double solid yellow center line.

2. Solid white pavement edge line where street does not have curb and to mark bike lanes.

3. Skip yellow lines to designate lanes in multi-lane streets.

4. Traffic stripe shall be six (6) inches wide on GDOT streets and **County** streets designated as arterial. Traffic stripe shall be four (4) inches wide on all other streets.

5. White crosshatched lines for crosswalks at schools and at intersections.

6. White stop bars at stop streets.

7. Symbols such as turn arrows, one-way arrows, etc.

8. Wording such as “STOP,” “SCHOOL,” etc.

9. All other striping, symbols, and wording required by MUTCD.

PART 3 - EXECUTION

3.01 PAVEMENT REPLACEMENT

A. The **Contractor** shall obtain prior approval from the **County** for any paving subcontracts.

B. The **Contractor** shall replace all pavements following the guidelines established by the Georgia Department of Transportation and other authorities having jurisdiction.

C. Where paved streets, sidewalks, driveways, and gutters are removed within the construction limits as specified, such replacement shall be paid for at the respective unit prices in the Bid Form. Such pavements removed or damaged by the **Contractor** beyond the specified construction limits shall be replaced in accordance with these specifications at the **Contractor's** expense.

D. Where chert, gravel, slag, or other unpaved street or driveway surfaces are removed or damaged, they shall be replaced with the same type of materials that were removed as an incidental part of the Work and no specific payment therefore shall be allowed. Unpaved drives shall be topped with gravel at no additional cost to the **County**.

E. In replacing pavements and unpaved surfaces, the materials used and the construction methods shall comply with the applicable requirements of the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, latest edition.

F. Where shown on the Plans, service lines and small diameter pipes, eight (8) inches in diameter or less located across paved surfaces shall be installed by boring or other approved methods that shall not require cutting or removing the pavement where feasible. This is to be approved by the **County**.

G. All concrete pavement replaced shall not be less than four (4) inches thick or equal to the original if greater than four (4) inches.

H. Pavements replaced shall be of the same type of construction as was removed, except that no asphalt surface replaced shall be less than three (3) inches thick consisting of a binder and seal coat. Wearing surfaces shall be slag sealed in accordance with the requirements established by GDOT.

3.02 SURFACE PREPARATION

A. Graded Aggregate Base Course:

1. The **Contractor** shall check subgrade for conformity with elevations and section immediately before placing aggregate base material.

2. The **Contractor** shall place aggregate base material in compacted layers not more than six (6) inches thick, unless continuing tests indicate that the required results are being obtained with thicker layers.

3. In no case shall more than eight (8) inches of compacted base be placed in one lift.

4. The **Contractor** shall spread, shape, and compact all aggregate base material deposited on the subgrade during the same day.

5. The compacted base shall have sufficient stability to support construction traffic without pumping and meet minimum contract compaction specifications.

6. If compacted base becomes unstable as a result of too much moisture, the base material and underlying subgrade, if necessary, shall be dried or removed and reworked to a moisture content that can be recompacted to meet minimum contract compaction specifications at the expense of the **Contractor**.

B. Loose and Foreign Material:

1. The **Contractor** shall remove loose and foreign material from the surface immediately before application of paving.

2. The **Contractor** shall use power brooms or blowers, and hand brooming as required.

3. The **Contractor** shall not displace surface material.

C. Prime Coat:

1. The **Contractor** shall uniformly apply at a rate of 0.20 to 0.50 gallon per square yard over compacted and cleaned subbase surface.

2. The **Contractor** shall apply enough material to penetrate and seal, but not flood the surface.

3. The **Contractor** shall allow material to cure and dry as long as required to attain penetration and evaporation of volatile, and in no case less than twenty-four (24) hours unless otherwise acceptable to the **County**.

4. The **Contractor** shall blot excess asphalt with just enough sand to prevent pick-up under traffic.

5. The **Contractor** shall remove loose sand before paving.

D. Tack Coat:

1. The **Contractor** shall dilute material with equal parts of water and apply to contact surfaces of previously constructed asphalt concrete or Portland cement concrete and similar surfaces.

2. The **Contractor** shall apply at a rate of 0.05 to 0.15 gallons per square yard of surface.

3. The **Contractor** shall apply tack coat by brush to contact surfaces of curbs, gutters, manholes, and other structures projecting into or abutting asphalt concrete pavement.

4. The **Contractor** shall allow surfaces to dry until material is at a condition of tackiness to receive pavement.

3.03 EQUIPMENT

A. The **Contractor** shall provide size and quantity of equipment to complete the work specified in this section within the Project Schedule.

B. Bituminous pavers shall be self-propelled that spread hot asphalt concrete mixtures without tearing, shoving, or gouging surfaces, and control pavement edges to true lines without use of stationary forms.

C. Rolling equipment shall be self-propelled, steel-wheeled, and pneumatic-tired rollers that can reverse direction without backlash.

D. The **Contractor** shall provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters, and other miscellaneous small tools to complete the work specified in this section.

3.04 ASPHALTIC CONCRETE PLACEMENT

A. The **Contractor** shall place asphalt concrete mix on prepared surfaces, spread, and strike-off using paving machine.

B. The **Contractor** shall spread the asphaltic concrete mixture at a minimum temperature of two-hundred and twenty-five (225) degrees F.

C. Inaccessible and small areas may be placed by hand.

D. The **Contractor** shall place each course at a thickness such that when compacted it shall conform to the indicated grade, cross-section, finish thickness, and density indicated in the Plans.

E. Pavement Placing:

1. Unless otherwise directed by the **County**, the **Contractor** shall begin placing asphaltic concrete along the centerline of areas to be paved on crowned section, and at high side of sections on one-way slope, and in direction of traffic flow.

2. After first strip has been placed and rolled, the **Contractor** shall place succeeding strips and extend rolling to overlap previous strips.

3. The **Contractor** shall complete base courses for a section before placing surface courses.

4. The **Contractor** shall place the asphaltic concrete mixture in as continuous an operation as practical.

F. Hand Placing:

1. The **Contractor** shall spread, tamp, and finish the asphaltic concrete mixture using hand tools in areas where machine spreading is not possible,

as acceptable to the **County**.

2. The **Contractor** shall place the asphaltic concrete mixture at a rate that shall ensure handling and compaction before mixture becomes cooler than acceptable working temperature.

G. Joints:

1. The **Contractor** shall carefully make joints between old and new pavements, or between successive days work, to ensure a continuous bond between adjoining work.

2. The **Contractor** shall construct joints to have the same texture, density, and smoothness as adjacent sections of asphalt concrete course.

3. The **Contractor** shall clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat.

4. The **Contractor** shall offset transverse joints in succeeding courses not less than twenty-four (24) inches.

5. The **Contractor** shall cut back edge of previously placed course to expose an even, vertical surface for full course thickness.

6. The **Contractor** shall offset longitudinal joints in succeeding courses not less than six (6) inches.

7. When the edges of longitudinal joints are irregular, honeycombed, or inadequately compacted, the **Contractor** shall cut back unsatisfactory sections to expose an even, vertical surface for full course thickness.

3.05 ASPHALTIC CONCRETE COMPACTION

A. The **Contractor** shall provide sufficient rollers to obtain the required pavement density.

B. The **Contractor** shall begin rolling operations as soon after placing, as the mixture shall bear weight of roller without excessive displacement.

C. The **Contractor** shall not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set.

D. The **Contractor** shall compact the asphaltic concrete mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

E. The **Contractor** shall start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. The **Contractor** shall roll to slightly different lengths on alternate roller runs.

F. The **Contractor** shall not roll centers of sections first under any circumstances.

G. Breakdown Rolling:

1. The **Contractor** shall accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and the outside edge.

2. The **Contractor** shall operate rollers as close as possible to paver without causing pavement displacement.

3. The **Contractor** shall check crown, grade, and smoothness after breakdown rolling.

4. The **Contractor** shall repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling.

H. Second Rolling:

1. The **Contractor** shall follow breakdown rolling as soon as possible, while the asphaltic concrete mixture is hot and in condition for compaction.

2. The **Contractor** shall continue second rolling until the asphaltic concrete mixture has been thoroughly compacted.

I. Finish Rolling:

1. The **Contractor** shall perform finish rolling while the asphaltic concrete mixture is still warm enough for removal of roller marks.

2. The **Contractor** shall continue rolling until roller marks are eliminated and the course has attained specified density.

J. Patching:

1. The **Contractor** shall remove and replace defective areas.

2. The **Contractor** shall cut-out and fill with fresh, hot asphalt concrete.

3. The **Contractor** shall compact by rolling to specified surface density and smoothness.

4. The **Contractor** shall remove deficient areas for full depth of course.

5. The **Contractor** shall cut sides perpendicular and parallel to direction of traffic with edges vertical.

6. The **Contractor** shall apply tack coat to exposed surfaces before placing new asphaltic concrete mixture.

3.06 PAVEMENT MILLING

A. In street areas where pavement replacement occurs, pavement milling shall be performed by the **Contractor** to eliminate excessive buildup of pavement. The depth of milling shall be 1-1/2" from curb to curb measured at each edge of pavement or as directed by the **County**.

3.07 CLEANING AND PROTECTION

A. Cleaning: After completion of paving operations, the **Contractor** shall clean surfaces of excess or spilled asphalt materials to the satisfaction of the **County**.

B. Protection:

1. After final rolling, the **Contractor** shall not permit vehicular traffic on asphaltic concrete pavements until it has cooled and hardened, and in no case no sooner than six (6) hours.

2. The **Contractor** shall provide barricades and warning devices as required to protect pavement and the general public.

C. Maintenance: The **Contractor** shall maintain the surfaces of pavements until the acceptance of the Work. Maintenance shall include replacement, overlaying, milling, and reshaping as necessary to prevent raveling of the road material, the preservation of smooth surfaces, and the repair of damaged or unsatisfactory surfaces, to the satisfaction of the **County**.

3.08 STANDARD GRANITE CURB, GRADE B

A. This work shall consist of furnishing and installing the standard granite curb where indicated in the Plans or directed by the **County**. In general, granite curb required to be installed shall match existing granite curb that has been removed or damaged in the progress of the Work.

B. When existing granite curb will conflict with pipe installation, the **Contractor** shall carefully remove, clean, and store the granite curb. The **Contractor** shall remove damaged granite curb from the job site. Granite curb that is acceptable to the **County** may be re-installed.

C. Installation of standard granite curb, Grade B, shall include saw cutting existing asphalt concrete pavement a minimum of one (1) inch and removing remaining pavement to subgrade, excavation of base and subgrade as necessary to install the granite curbing and backfilling and compacting of the installation.

3.09 SPECIALTY BRICK PAVER REPLACEMENT

A. This work shall consist of replacing existing brick pavement required to be removed for installation of sanitary sewers or connection of services.

B. Existing brick pavers removed to accommodate sanitary sewers or services or damaged by the Work shall be removed in neat, rectangular sections the full width of the pavement as shown on the Plans. Existing concrete base slabs shall be cut with a concrete saw and removed prior to replacement. Replacement construction shall match existing pavement section including concrete base slab.

3.10 SPECIAL BRICK SIDEWALK REPLACEMENT

A. This work shall consist of replacing existing brick sidewalks required to be removed for connection of services or for installation of sanitary sewers.

B. Existing brick sidewalk removed to accommodate the sanitary sewers or services or damaged by the Work shall be removed in neat, rectangular sections the full width of the sidewalk or driveway on a line perpendicular to the street. Existing concrete base slabs shall be cut with a concrete saw and removed prior to replacement. Brick pavers shall be laid on a four (4) inch thick concrete base slab and meet the same requirements as Standard Concrete Sidewalk four (4) inches thick.

3.11 STAMPED HEXAGONAL CONCRETE PAVERS

A. This work shall consist of replacing existing hexagonal concrete pavers required to be removed for connections of services or for installation of sanitary sewers.

B. Existing hexagonal pavers removed to accommodate the sanitary sewers or services or damaged by the Work shall be removed the full width of the sidewalk or driveway on a line perpendicular to the street. The stamped hexagonal concrete pavers shall be constructed according to the Standard Detail. Prior to beginning construction of the first section of stamped pavers, the **Contractor** shall construct a four (4) foot by a four (4) foot test panel for approval by the **County**. A standard concrete sidewalk four (4) inches thick shall be poured. When the concrete has achieved sufficient set, the paver pattern imprint shall be created by pushing the form into the concrete to the specified depth and then carefully removing the form. If the constructed stamped pavers do not conform to the test panel, the unsatisfactory sections shall be removed and reconstructed by the **Contractor** to the satisfaction of the **County** without additional cost to the **County**.

3.12 PAVEMENT MARKINGS

A. Construction of pavement markings shall be performed according to the requirements of GDOT Standard Specifications Construction of Transportation Systems, latest edition, Section 653.03.

+++ END OF SECTION 02510 +++

SECTION 02515
PROTECTION OF EXISTING SITE

PART 1 - GENERAL

1.01 ROADS

The **Contractor** shall be aware of the existing paved entrance roadway. All equipment shall be unloaded off the paved sections. No track equipment shall be allowed on paved roads, without the use of pads. Any portion of the existing paving damaged due to equipment will be repaired and maintained by the **Contractor** at no additional cost to the **County**. Final repairs and repaving will require restoration of the base, and the asphalt shall be replaced per the typical trench repair shown in the plans.

1.02 GRASSING

The **Contractor** shall re-grass any places where he has destroyed the existing grassed areas. This shall include any areas where equipment has traveled, storage sheds have been constructed, trailers have been installed, or any areas disturbed. Grading and grassing of any disturbed areas shall be described elsewhere in these specifications.

1.03 PIPING

The **Contractor** shall repair any piping damaged during construction. All damaged piping shall be reported to the engineer before repairs are made. The **County** will assist in the location of underground piping, but the **Contractor** shall be responsible for digging down and verifying the exact locations.

1.04 PARKING

The **Contractor** shall prepare a place for the parking of construction equipment and vehicles. The existing parking lot and paved roads will not be used by the **Contractor** during inclement weather for the purpose of parking vehicles.

1.05 UTILITIES

The **Contractor** shall locate and flag all power, control, phone, water, chemical, air, water and wastewater lines prior to beginning of construction. The existing drawings are for general location and layout. The **Contractor** shall make itself familiar and locate all utilities prior to construction of any phase. The **Contractor** will be solely responsible for repairs to any utilities damaged.

END OF SECTION

SECTION 02521
CONCRETE SIDEWALKS, CURBS AND GUTTERS

PART 1 - GENERAL

1.01 SCOPE

A. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for construction of concrete sidewalks, concrete curb, concrete gutter and concrete combined curb and gutter, which shall consist of monolithic curb and gutter respectively, all constructed of Portland cement concrete, at the locations, and to the lines, grades, cross section, form and dimensions indicated on the Drawings.

B. Cement concrete sidewalks, concrete curb, gutter and combined curb and gutter shall include all necessary excavation, unless otherwise indicated, and subgrade preparation; backfilling, and final clearing up; and completion of all incidentals thereto, as indicated on the Drawings or as directed by the **County**.

C. Related Work Specified Elsewhere:

1. Section 02200 - Earthwork
2. Section 02112 - Route Clearing
3. Section 02510 - Pavement Repair
4. Section 03200 - Concrete Reinforcement and Doweling
5. Section 03300 - Cast-In-Place Concrete

1.02 PRODUCT HANDLING

A. Protection: Use all means necessary to protect concrete materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacement: In the event of damage, immediately make all repairs and replacements necessary to the approval of the **County** at no additional cost to the **County**.

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300.

PART 2 - PRODUCTS

2.01 CONCRETE REINFORCEMENT

A. Concrete reinforcement shall conform to Section 03200 - Concrete Reinforcement and Dowelling.

2.02 CONCRETE AND RELATED MATERIALS

A. General: Concrete and related materials including, but not necessarily limited to, joint materials, membranes and curing compounds shall conform to Section 03300 - Cast-In-Place Concrete.

B. Class: All concrete shall be Class B three thousand (3,000) psi and conform to requirements of Section 03300.

C. Water used in mixing concrete shall be fresh, clean, potable water free from injurious amounts of oil, acid, alkali, vegetable, wastewater and/or organic matter.

D. Admixtures shall meet the following requirements:

1. Except as herein specified, no curative or hardening admixtures shall be used.
2. An air entrainment agent capable of providing three to six (3 to 6) percent air shall be used. Air entraining admixtures that are added to concrete mixtures shall conform to ASTM C 260 for Air Entraining Admixtures for Concrete.

F. Sub-base shall be constructed of durable material such as bank-run gravel. Minimum depth of sub-base shall be three (3) inches.

G. Joint filler shall be a non-extruding joint material conforming to AASHTO M21 3 for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (non-extruding and resilient bituminous types). The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint unless otherwise specified by the **County**.

PART 3 - EXECUTION

3.01 EARTHWORK

A. General: All earthwork shall be performed in accordance with Section 02200, Earthwork, and as specified in this Section.

B. Backfilling

1. After the subgrade for sidewalks is compacted and at the proper grade, spread three (3) inches or more of sub-base material. Sprinkle with water and compact by rolling or other approved method. Top of the compacted gravel shall be at the proper level to receive the concrete.
2. After the concrete has set sufficiently, the spaces on both sides of the curb, gutter, and combined curb and gutter shall be backfilled, and the materials compacted and left in a neat and workmanlike condition.
3. Curbs to be used in the construction of asphalt pavements shall be backfilled prior to placement of base material for asphalt pavement.

3.02 SUBGRADE PREPARATION

A. The subgrade shall be formed by excavating to the required depth below the finished surface of the respective types, in accordance with the dimensions and designs indicated on the Drawings or as directed by the **County**, and shall be of such width as to permit the proper installation and bracing of forms. The subgrade shall be compacted by hand tamping and all soft, yielding or unsuitable material shall be removed and backfilled with satisfactory material and again compacted thoroughly to ninety-eight (98) percent of dry density per ASTM 698 and finished to a smooth and unyielding surface. The finished grade shall be to the dimensions and design indicated on the Drawings or as directed by the **County** for the bottom of the proposed construction.

3.03 CONCRETE CURB AND GUTTER CONSTRUCTION

A. Construct curbs to lines and grade shown or established by the **County**. Curbs shall conform to the details shown on the Drawings.

B. Forming:

1. Forms shall be metal and of an approved section. They shall be straight, free from distortions, and shall show no vertical variation greater than one-eighth (1/8) inch in ten (10) feet, and shall show no lateral variation greater than one-quarter (1/4) inch in ten (10) feet from the true plane surface on the vertical face of the form.
2. Forms shall be of the full depth of the structure and be so constructed as to permit the inside forms to be securely fastened to the outside forms.
3. Securely hold forms in place true to the lines and grades indicated on the Drawings.
4. Wood forms may be used on sharp turns and for special sections as approved by the **County**.
5. Where wooden forms are used, they shall be free from warp and the nominal depth of the structure.
6. All mortar and dirt shall be removed from forms and all forms shall be thoroughly oiled or wetted before any concrete is deposited.
7. The supply of forms shall be sufficient to permit their remaining in place at least twelve (12) hours after the concrete has been placed.

C. Joints:

1. Joints shall be constructed as indicated on the Drawings and as specified.
2. Construct joints true to line with their faces perpendicular to the surface of the structure and within one-quarter (1/4) inch of their designated position.
3. Thoroughly spade and compact the concrete at the faces of all joints to fill all voids.
4. Install expansion joint materials at the point of curve at all street returns.
5. Install expansion joint material behind the curb at abutment to sidewalks and adjacent structures.
6. Place contraction joints every ten (10) feet along the length of the curbs and gutters.
7. Form contraction joints using steel templates or division plates that

conform to the cross section of the structure. Leave the templates in place until the concrete has set sufficiently to hold its shape, but remove them while the forms are still in place.

8. Contraction joint templates or plates shall not extend below the top of the steel reinforcement or shall be notched to permit the reinforcement to be continuous through the joint.
9. Contraction joints shall be a minimum of one and one half (1-1/2) inches deep.

D. Finishing:

1. Strike off the surface with a template, and finish the surface with a wood float using heavy pressure, after which, contraction joints shall be made and the surface finished with a wood float or steel trowel.
2. Finish the face of the curbs at the top and bottom with an approved finishing tool of the radius indicated on the Drawings.
3. Finish edges with an approved finishing tool having a one quarter (1/4) inch radius.
4. Provide a final broom finish by lightly combing with a stiff broom after troweling is complete.
5. The finished surface shall not vary more than one-eighth (1/8) inch in ten (10) feet from the established grade.

E. Concrete Curing:

1. After finishing operations have been completed and immediately after the free water has left the surface, the surface of the structure shall be completely coated and sealed with a uniform layer of curing compound specified in Section 03300 - Cast-In-Place Concrete.
2. The compound shall be applied in one or two applications as directed by the **County**. When the compound is applied in two (2) increments, the second application shall follow the first application within thirty (30) minutes.
3. The compound shall be applied continuously by means of an automatic self-propelled, pressure sprayer as approved by the **County** at the rate directed by the **County**, but not less than one (1) gallon per two hundred (200) square feet of surface.
4. The equipment shall provide adequate stirring of the compound during application.
5. Should the method of applying the compound not produce uniform coverage, its use shall be discontinued, and the curing shall be by another method approved by the **County**.

F. Protection:

1. Provide and use sufficient coverings for the protection of the concrete in case of rain or breakdown of curing equipment.
2. Provide necessary barricades and lights to protect the work and rebuild or repair to the approval of the **County**. All damage caused by people, vehicles, animals, rain, the **Contractor**'s operations and the like shall be repaired by the **Contractor** at no additional expense to the **County**.

3.04 SIDEWALK CONSTRUCTION

A. Sidewalks shall be four (4) inches thick.

B. At locations where the new sidewalk is to abut existing concrete, saw cut concrete for a depth of two (2) inches and chip the old concrete back to sound material on a straight line, clean the surface, and apply a neat cement paste just prior to pouring the new sidewalk.

C. Joint:

1. Place preformed asphalt expansion joints as in the adjacent curb, where the sidewalk ends at the curb, and around posts, poles, or other objects protruding through the sidewalk.

2. Provide contraction joints transversely to the walks at locations opposite the construction joints in the curb. These joints shall be straight and at right angles to the surface of the walk.

D. Finishing:

1. Broom the surface with a fine-hair broom at right angles to the length of the walk and tool all edges, joints, and markings. Mark the walks transversely with a jointing tool.

E. Concrete Curing

1. After the finishing operations have been completed and immediately after the free water has left the surface, the surface of the structure shall be completely coated and sealed with a uniform layer of curing compound specified in Section 03300 - Cast-In-Place-Concrete.
2. The compound shall be applied in one or two applications as directed by the **County**. When the compound is applied in two (2) increments, the second application shall follow the first application within thirty (30) minutes.
3. The compound shall be applied continuously by means of an automatic self-propelled, pressure sprayer as approved by the **County** at the rate directed by the **County**, but not less than one (1) gallon per two hundred (200) square feet of surface.
4. The equipment shall provide adequate stirring of the compound during application.
5. Should the method of applying the compound not produce uniform coverage, its use shall be discontinued, and the curing shall be by another method approved by the **County**.

F. Protection:

1. Protect the sidewalks from damage for a period of seven days.
2. All damage caused by people, vehicles, rain, animals, and the **Contractor** shall be repaired by the **Contractor** at no additional expense to the **County**.

3.05 REPLACEMENT CONCRETE CURB AND SIDEWALK

A. When a section is removed, the existing sidewalk or curb shall be cut to a neat line, perpendicular to both the centerline and the surface of the concrete slab. Existing concrete shall be cut along the nearest existing construction joints; if such joints do not exist, the cut shall be made at minimum distances shown on the Drawings.

B. Existing concrete sidewalks and curbs that have been cut and removed for construction purposes shall be replaced with the same width and surface as the portion removed. Sidewalks shall have a minimum uniform thickness of four (4) inches. The new work shall be neatly jointed to the existing concrete so that the surfaces of the new work shall form an even, unbroken plane with the existing surfaces.

C. All work shall conform to the requirements for new sidewalks and curbs as detailed in this Section.

3.06 CLEANING

A. All excess or unsuitable material shall be disposed of as specified in Section 02050, Demolition.

B. All surfaces of the Work and adjacent surfaces shall be broom clean. The **Contractor** shall use pressure washing and other means approved by the **County** to remove splashed and spilled concrete from the Work and adjacent surfaces.

C. Disturbed seeded areas shall be reseeded per requirements of Section 02485 - Seeding.

+++ END OF SECTION 02521 +++

SECTION 02535

GRAVITY FLOW SANITARY SEWERS

PART 1 - GENERAL

1.01 SCOPE

A. The work covered under this section includes providing all labor, equipment, and materials required to furnish, install, test, and inspect gravity flow sanitary sewers as shown on the Plans and specified in this section.

B. Unless directed otherwise in writing by the **County**, the **Contractor** shall use only the pipe sizes and materials specifically designated on the Plans.

C. Related Work Specified Elsewhere:

1. Section 01210 - Measurement and Payment
2. Section 02060 - Crushed Stone Aggregate
3. Section 02200 - Earthwork
4. Section 02140 - Dewatering
5. Section 02324 - Trenching and Trench Backfill
6. Section 02537 - Ductile Iron Sanitary Sewer Pipe and Fittings
7. Section 02545 - Polyvinyl Chloride Sanitary Sewer Pipe
8. Section 02641 - Precast Concrete Manholes
9. Section 02650 - Testing for Acceptance of Sanitary
10. Section 02750 - Bypass Pumping
11. Section 02920 - Site Restoration
12. Section 03300 - Cast-In-Place Concrete

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and **Section 01300-Submittals**. In addition, the following specific information shall be provided:

1. Proposed methods, equipment, materials, and sequence of operations for sewer construction to minimize disruption of utilities and to occupied facilities on adjacent property

2. Manufacturers' instructions indicating special procedures required to install the products specified

3. Certifications that the products meet or exceed the requirements specified in these Specifications

4. Set of plans (modified to show as-built conditions)

5. Test reports

1.03 QUALITY ASSURANCE

A. Reference Standards: The **Contractor** shall comply with the applicable provisions and recommendations of the latest editions of the following standards, except as otherwise shown on the Plans or specified in these Specifications.

1. AASHTO T180 - Standard Specification For Moisture-Density Relations of Soils Using a 4.54-kg (10-pound) Rammer and a 457-mm (180-inch) Drop

2. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe

3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort 12,400 ft-lbf/ft3, or 600 kN-m/m3).

5. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.

6. ASTM C700 - Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.

7. ASTM D3034 - Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings

8. ASTM D1557 - Standard Test Method for Laboratory, Compaction Characteristics of Soils Using Modified Proctor Effort 56,000 ft-lbf/ft3, or 2,700 kN-m/m3)

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

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

11. American Water Works Association (AWWA), Latest Revisions

B. The **Contractor** shall provide the **County** with the product manufacturers' written certification that all products furnished comply with all applicable provisions of these Specifications. Except as may be modified herein, all materials used in the manufacture of pipe, linings, manholes, and castings shall be new, and shall be tested in accordance with the referenced standards, as applicable. The **Contractor** shall be responsible for performing and paying for sampling and testing as necessary for the certifications. The **County** shall have the right to witness testing of the materials, provided that the **Contractor's** schedule is not delayed for the convenience of the **County**.

C. The sewer pipe shall be tested and inspected at the place of manufacture for all requirements of the latest applicable ASTM standards, and certified copies of the test report covering each shipment shall be submitted to the **County** prior to laying. After delivery, pipe and fittings shall be subject to inspection by and approval of the **County**. No broken, cracked, misshaped, or otherwise damaged or unsatisfactory pipe, fittings, or damaged concrete lining shall be used.

D. Each pipe shall be clearly marked as required by the governing ASTM standard specifications to show pipe class, date of manufacture, date coated, type of coating, and manufacturer's trademark.

E. All pipe, accessories, and specials shall be new material.

F. If directed by the **County**, each pipe manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service shall be furnished for a minimum of 5 days during initial pipe installation.

G. All pipes shall be subject to inspection by the **County** at the place of manufacture. The **Contractor** shall notify the **County** in writing of the manufacturing start date at least 14 days prior to the start of manufacturing. The **Contractor** shall be responsible for all inspection costs.

H. All pipes shall be inspected upon arrival. If any portion of a shipment is found to be defective in diameter or thickness, the entire shipment shall be rejected and removed from the site of the Work at no cost to the **County**. Each section of pipe shall again be thoroughly inspected immediately prior to lowering it into the trench to ensure that the interior is clean and to check for joint scratches, chipped ends, and imperfect gasket seats. Any defective pipe or fitting discovered after the pipe is laid shall be, without additional

charge to the **County**, removed and replaced with a satisfactory pipe or fitting.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. The **Contractor**/**County** shall inspect pipe materials and fittings upon arrival at the site of the Work.

B. The **Contractor** shall handle and store pipe materials and fittings to protect them from damage due to weather, impact, shock, shear, or free fall. The **Contractor** shall not drag pipe and fittings along the ground. The **Contractor** shall not roll pipe unrestrained from delivery trucks.

C. The **Contractor** shall use mechanical means to move or handle pipe. The **Contractor** shall employ acceptable clamps, rope, or slings around the outside barrel of pipe and fittings.

PART 2 - PRODUCTS

2.01 PIPE MATERIALS

A. All materials used in the construction of gravity flow sanitary sewers shall be new, unused, and of the sizes indicated on the Plans.

B. All materials shall be in strict compliance with the required standards and specifications, including those published by ASTM, ANSI, and AWWA.

C. At points of the sewer where a change in pipe classification is shown on the Plans, the **Contractor** shall begin at the next joint of pipe rather than cutting the pipe and constructing a collar unless there is a change in horizontal or vertical alignment. In the event the pipe is cut, there shall be no torch cutting; only saw cutting shall be allowed.

D. Ductile Iron Pipe and fittings shall conform to the requirements of **Section 02537 - Ductile Iron Sanitary Sewer Pipe and Fittings**.

E. Reinforced Concrete Sanitary Sewer Pipe shall conform to the requirements of approved plans and the submittal.

F. Vitrified Clay Pipe shall conform to the requirements of approved plans and the submittal.

G. Polyvinyl Chloride Gravity Sewer Pipe shall conform to the requirements of **Section 02545 - Polyvinyl Chloride Gravity Sewer Pipe**.

2.02 TRANSITION COUPLINGS

Transition joints between sewer pipes of different materials shall be accomplished by the use of **County**-standard concrete collar walls. Prior to using any other material, the **Contractor** shall submit plans to the **County** for approval.

2.03 APPURTENANCES

A. Service connections shall conform to the requirements of **Section 02537 - Ductile Iron Sanitary Sewer Pipe and Fittings and Section 02622 - PVC Pipe and Fittings**

B. Manholes shall conform to the requirements of **Section 02641 - Precast Concrete Manholes**.

2.04 CLEAN-OUTS

A. Standard Cleanout Assembly:

B. Poly Vinyl Chloride (PVC) pipe for standard clean-outs shall be as indicated in the table below:

Standard Minimum Thickness Type PVC(1)	Wall	Acceptable Manufacturers
ASTM D 3034 SDR 35 12454B	Solid Wall	Open
(1) As specified in ASTM D 1784.		

C. All pipes shall have a minimum pipe stiffness (PS) of forty six (46) psi at five (5) percent deflection, as determined by ASTM D 2412.

D. Fittings

1. Fittings shall be manufactured in accordance with ASTM D 3034. PVC compound shall be 12454B or 12454C as specified in ASTM D 1784.

2. Fittings shall be molded in one piece with no solvent-welded joints. Minimum socket depths shall be as specified in ASTM D 3034, Table 2.

E. Joints for pipe and fittings shall be of the integral bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage, when tested in accordance with ASTM D 3212. Gaskets shall meet the requirements of ASTM F 477. The joint

system shall be subject to approval by the **County** and shall be identical for pipe and fittings.

F. Flexible Adapter Couplings:

1. Couplings shall be elastomeric plastic sleeves designed to connect pipes of dissimilar materials. Adapters shall provide a positive seal against infiltration and exfiltration, and remain leakproof and root-proof up to 4.3 psi. The adapter manufacturer shall provide all stainless steel clamps and required accessories.

2. Couplings shall be products equal to Fernco and shall be installed in accordance with the manufacturer's recommendations.

2.05 EXCAVATION AND BACKFILL

A. Trench excavation shall meet the guidelines presented by the manufacturer to protect piping from trench loads which exceed design guidelines, Pipe backfill materials and compaction shall conform to the requirements of **Section 02200 - Earthwork** and **Section 02324 - Trenching and Trench Backfilling**.

B. Topsoil shall conform to the requirements of **Section 02920 - Site Restoration**.

PART 3 - EXECUTION

3.01 GENERAL

A. The **Contractor** shall control traffic in accordance with the requirements of **Section 01550 - Traffic Regulation**.

B. All activities shall be performed in accordance with the manufacturers' recommendations and regulations established by OSHA. Particular attention shall be paid to those safety requirements involving sheeting and shoring, working with scaffolding, and entering confined spaces.

C. The **Contractor** shall identify the locations of all existing underground utilities prior to commencing excavation activities. Georgia law mandates that, before beginning all mechanical digging or excavation work, the **Contractor** shall contact Georgia 811 by using eRequest on www.Georgia811.com or by calling 811 or 1-800-282-7411. The **Contractor** shall consult with utility companies to verify the locations of existing underground utilities.

D. In the event of damage to existing utility facilities, or uncovering damaged, broken, or disturbed utilities, the **Contractor** shall notify the agency or

company owning any utility line that is damaged, broken, or disturbed. The **Contractor** shall obtain approval from the **County** and the utility owner prior to performing any temporary or permanent repairs, or any relocation of utilities.

E. The **Contractor** shall install and operate a dewatering system in accordance with the requirements of **Section 02140 - Dewatering**.

F. Where wastewater flow diversion is required for the performance of the Work, the **Contractor** shall provide wastewater flow diversion in accordance with the requirements of **Section 02750 - Bypass Pumping** and meet all Federal, State and **County** codes.

3.02 PIPE LAYING

A. The **Contractor** shall install the pipe in accordance with the pipe manufacturer's recommendations and as specified in this section.

B. The **Contractor** is responsible for accurately placing pipe to the exact line and grade shown on the Plans. The control of vertical and horizontal alignments shall be accomplished by the use of a laser beam instrument. When the laser is used, the elevation and alignment of the pipe shall be checked by transit and level rod every 50 feet for smaller pipe and every joint for pipe forty eight (48) inches and larger. Other approved methods of controlling vertical and horizontal alignments may be used if specifically authorized by the **County**. The pipe section may be adjusted by the use of "come-along" of approved design and anchorage. The practice of bumping or snatching (with backhoe or crane, etc.) used to adjust pipe after placement in the trench, shall not be permitted. The **Contractor** shall furnish all labor and materials necessary for controlling the line and grade.

C. Each piece of pipe and special fitting shall be carefully inspected before it is placed, and no defective pipe shall be laid in the trench. Before a sewer pipe is placed in position in the trench, the bottom and sides of the trench shall be carefully prepared. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells uphill. Trench bottoms found to be unsuitable for foundations shall be undercut and brought to exact line and grade with pipe cushion, concrete cradles, and foundation backfill, or as directed by the **County**.

D. For bell and spigot pipe, bell holes shall be of sufficient size to allow ample room for properly making the pipe joints. Bell holes shall be cut no more than five (5) joints ahead of pipe laying. The bottom of the trench between bell holes shall be carefully graded so that the pipe barrel shall rest on a solid foundation for its entire length. Each joint shall be laid so that it will form a close concentric joint with adjoining pipe and so as to avoid sudden offsets or inequalities in the flow line.

E. Water shall not be allowed to run or stand in the trench while pipe laying is in progress or before the trench has been backfilled. The **Contractor** shall not open up at anytime more trench than the **Contractor's** available pumping facilities are able to dewater. Movement of water that would tend to erode or affect the trench walls shall not be allowed by the **County**.

F. As the work progresses, the interior of all pipe in place shall be thoroughly cleaned. After each line of pipe has been laid, it shall be carefully inspected and all earth, trash, rags, and other foreign matter removed from the interior.

G. Backfilling of trenches shall be started immediately after the pipe is in place and the joints completed, inspected, and approved by the **County**.

H. At times when work is not in progress, open ends of pipe and fittings shall be securely closed, to the satisfaction of the **County**, so that trench water, earth, or other substances shall not enter the pipe or fittings.

3.03 JOINT CONSTRUCTION

A. For bell and spigot pipe, the inside of all bells and the outside of all spigots shall be wiped to remove all dirt, water, or other foreign matter so that their surfaces are clean and dry when the pipes are joined.

B. Rubber ring gasket joints for sewer pipe shall be installed according to the pipe manufacturer's specifications and recommendations. Extreme care shall be used in joining large-diameter pipe to avoid damaging the rubber ring or displacing it from the proper operating position.

C. Joints on ductile iron pipe sewers shall be compression joints, except where mechanical or flanged joints are called for on the Plans, and shall be installed according to the pipe manufacturers' specifications and recommendations.

D. After the joints have been completed, they shall be inspected by the **County** before they are covered. Any leaks or defects discovered at any time after completion of the Work shall be repaired immediately. Testing of gravity sewers shall be performed in accordance with the requirements of **Section 02650 - Testing for Acceptance of Sanitary Sewers**. All pipe in place shall be carefully protected from damage until the backfilling operations have been completed. Any pipe that has been disturbed after jointing shall be removed, the joint shall be cleaned and remade, and the pipe shall be re-laid at the **Contractor's** expense.

3.04 WYE CONNECTIONS

A. Wye branches shall be installed in sanitary sewer lines at all points shown on the Plans or directed by the **County**. If such branches are not to be used

immediately, they shall be closed with approved stoppers and shall be physically restrained.

B. All existing sanitary service lines shall be disconnected from the existing combined sewer and reconnected to the new sanitary sewer.

C. Wyes shall be installed in sanitary sewers so as to properly connect each existing house and to serve each vacant lot facing or abutting the street or alley in which the sewer is being laid and at such other locations as may be designated by the **County**. The exact location of each connection shall be recorded by the **Contractor** on the record drawings, utilizing conventional GPS survey, before backfilling and delivering said records to the **County**.

D. Wyes shall be standard manufactured wyes.

E. Standard manufactured tees shall only be installed with an approved submittal and directed by the **County**.

3.05 CONNECTING RISERS

A. Where shown on the Plans, included in the Special Conditions, or directed by the **County**, and where the depth of cut is over 8 feet or where the grade of a sanitary sewer is lower than necessary to drain abutting property, and at such other locations as may be designated by the **County**, connecting risers shall be installed to connect each existing house and to serve each vacant lot facing or abutting the street in which the sewer is being laid.

B. Connecting risers shall be sized in accordance with the plumbing code in effect at the time of construction, but shall not be smaller in size than shown on the Plans. Risers shall be installed from a wye connection to the elevation needed to connect house services, the elevations shown on the Plans, or as directed by the **County**. The wye connection shall be installed at the location shown on the Plans, and in accordance with the Detail Drawings. Open ends of connecting risers shall be closed with approved stoppers and be physically restrained. Backfilling shall be carefully done around risers and compacted to the equivalent density of the surrounding undisturbed material.

3.06 HOUSE SEWERS AND MULTIPLE DWELLING SEWERS

A. Stub-Outs for house service lines and multiple dwelling service lines shall be installed when stipulated in the Special Conditions or shown on the Plans. However, additional connections shall be installed by the **Contractor** when directed by the **County**.

B. House service lines for single dwelling units shall consist of 6-inch-diameter sewer pipes, and service lines for multiple dwelling units served by a single

line shall consist of 8-inch-diameter sewer pipes, constructed as specified in this section. If the plumbing code in affect at the time of construction specifies larger pipe or if the existing house service line is larger than the specified diameters, then the larger pipe shall be installed. House service line stub-outs for vacant lots shall be installed at the locations shown on the Plans or designated by the **County** to provide a service line from the tee in the sewer. House service line stub-outs shall be installed in accordance with the Detail Drawings. The open end of such stub-outs shall be closed with approved stoppers and properly restrained.

C. Cleanouts shall be installed for each continuous run of 100 feet and at each change in horizontal or vertical direction. Cleanouts shall be constructed in accordance with the Detail Drawings. Cleanouts shall be plugged with approved stoppers. Stoppers shall be properly restrained.

D. Backfilling for service lines shall commence immediately upon acceptance of the Work by the **County**. Backfill materials shall be as specified in **Section 02324 – Trenching and Trench Backfilling**, and shall be compacted to the equivalent density of the surrounding undisturbed material.

3.07 CONNECTING EXISTING SANITARY SEWERS TO NEW SANITARY SEWERS

A. All existing separate sanitary sewers shall be connected to new separate sanitary sewers, as shown on the Plans or as directed by the **County**. Connections shall be made by constructing a manhole or utilizing an existing manhole.

B. Connection of lateral collector sewers to large-diameter trunk sewers shall be made at existing manholes or new manholes.

C. Connections to existing manholes shall be made by coring a hole in the wall of the existing manhole, installing a boot, inserting the same pipe material as the mainline being constructed, filling around same with non-shrinking grout, and troweling the inside and outside surfaces of the joint to a neat finish.

D. Connections of existing separate sanitary sewers to new separate sanitary sewers shall be plugged, and shall remain plugged until final acceptance by the **County**.

3.08 TOLERANCES

Invert Elevations: The invert elevations shown on the Plans shall be for the invert at the centerline of the precast concrete manhole. Prior to setting the laser or other vertical alignment control system for the sewer upstream of the manhole, the **Contractor** shall verify the elevation of the sewer installed at the manhole. Should the elevation differ from that shown on the Plans, the **Contractor** shall take the following corrective action:

A. If the sewer is laid at negative grade, the **Contractor** shall remove and reinstall the sewer at the correct grade, at no additional cost to the **County**.

B. If the sewer is laid at a grade less than that shown on the Plans, thus reducing the sewer's capacity, the **County** may require the sewer to be removed and re-laid at the correct grade at no additional cost to the **County**.

C. If the sewer is laid at a grade greater than that shown on the Plans, and if the **Contractor** can show that there are no conflicts with upstream existing utilities or obstructions, with the **County**'s approval the **Contractor** shall adjust the grade of the next upstream manhole such that the next upstream manhole shall be set at the correct elevation. If such an adjustment, in the **County's** opinion, is substantial, the grade adjustment shall be spread over multiple sections of the sewer. If such an adjustment, in the **County**'s opinion, significantly reduces the sewer's capacity, the **County** shall require the **Contractor** to remove and relay that portion of the sewer laid at the improper grade.

3.09 PIPE PROTECTION

A. Where foundation conditions are not satisfactory, as determined by the **County**, the sewer pipe shall be protected with proper pipe protection, as shown on the Plans or as directed by the **County**.

B. The **County** may require plain concrete ditch checks on steep slopes and other locations to prevent erosion of the backfilled trench.

3.10 TESTING

All manholes shall be vacuum tested and all gravity flow sanitary sewer joints shall be pressure tested in accordance with the requirements of **Section 2650 - Testing for Acceptance of Sanitary Sewers**. Testing shall be performed in the presence of the **County**.

3.11 CLEANUP

A. After completing each section of the sewer line, the **Contractor** shall remove all debris and construction materials and equipment from the site of the Work; grade and smooth over the surface on both sides of the line; and leave the entire construction area in a clean, neat, and serviceable condition. The **Contractor** shall restore the site of the Work to the original or better condition in accordance with requirements of **Section 02920 - Site Restoration**.

B. Prior to requesting a final inspection, the **Contractor** shall remove and dispose of all shipping timbers, shipping bands, boxes, and other like debris brought to the site of the Work.

C. Any lawns, fences, drainage culverts, or property damaged by the sewer construction shall be repaired or replaced to equal or better condition than existing prior to commencement of the Work.

D. All shoulders, ditches, culverts, and other areas affected by the sewer construction shall be at the proper grades and smooth in appearance to provide positive drainage of the site of the Work.

E. All manhole covers shall be brought to grade, as shown on the Plans, or as directed by the **County**.

END OF SECTION

SECTION 02537
DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE

A. Provide all labor, materials, equipment and incidentals necessary to construct all ductile iron pipe and appurtenances as shown on the Drawings and as specified herein and the DeKalb County Department of Watershed Management Design Standards Manual.

B. Ductile iron pipe and appurtenances covered under this Section shall include all interior pipe and accessories to the outside face of structures and buildings, except where there is no joint at the outside face. Where there is no joint at the exterior face, this Section shall include all ductile iron pipe and accessories within two feet of the exterior face of the structure or building.

C. This Section includes piping and fittings in utility vaults and manholes.

1.02 SUBMITTALS

A. Complete shop drawings and product data on all piping and fittings shall be submitted to the Engineer in accordance with the requirements of Section 01340 of these Specifications.

B. Shop drawings shall indicate piping layout in plan and/or elevations and shall include a complete schedule of all pipe, fittings, specials, hangers and supports. Special castings shall be detailed showing all pertinent dimensions. Special coatings shall be clearly identified.

C. The **Contractor** shall furnish the Inspector with lists of all pieces of pipe and fittings in each shipment received. These lists shall give the serial or mark number, weight, class, size and description of each item received.

D. The **Contractor** shall submit written evidence to the Engineer that the products furnished under this Section will conform with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the pipe supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the **Contractor** furnish test reports from an independent testing laboratory on samples of pipe materials.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE (DIP)

A. Ductile iron pipe shall be utilized for all piping where shown on the Drawings.

B. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

Pipe Sizes (inches)	Pressure Class (psi)
8	350
14 - 18	350
20	300
24	250
30 - 54	200

C. Flanged pipe minimum wall thickness shall be equal to Special Thickness Class 53. Flanges shall be furnished and assembled onto the pipe by the manufacturer, not a pipe fabricator.

D. For restraint joint pipe, the manufacturer should determine the maximum required pipe length to provide horizontal and vertical deflection shown on the Drawings based on the type of restraint joint used.

2.02 FITTINGS AND ACCESSORIES

A. Fittings shall be ductile iron and shall conform to AWWA C110/ANSI A21.10 or
AWWA C153/ANSIA21.53 with a minimum rated working pressure of 250 psi.

B. Flanged elbow fittings shall be ANSI pattern using short radius elbows except where noted differently on the Drawings. Special fittings, ductile iron wall pipes and sleeves shall conform to the dimensions and details as shown on the Drawings.

C. Thrust Collars: Thrust collars shall be welded-on ductile iron body type capable of withstanding a thrust due to 250 psi internal pressure on a dead end from either direction on that pipe size. The welded-on collars shall be continuously welded to the pipe by the pipe manufacturer.

D. Solid sleeves shall permit the connection of plain end ductile iron pipe. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for long pattern and have a minimum pressure rating of 250 psi. Solid sleeves shall have mechanical or restrained joints as specified in this Section and as shown on the Drawings.

Solid sleeves shall be used only in locations shown on the Drawings or at the direction of the Engineer.

E. Restrained Flange Adapter (RFA): The RFA shall permit the connection of unthreaded, ungrooved, open-ended ductile iron pipe to ANSI/ASME B16.1, Class 125 flanges. The RFA shall meet the test requirements of ANSI/ASME B16.1 for Class 125 flanges. The RFA shall be a ductile iron casting incorporating gripping wedges and gasket. The gasket shall provide a compression seal between the RFA, the pipe and the adjacent flange. RFAs are to be used only in locations specifically shown on the Drawings and shall be installed in accordance with the manufacturer's recommendations. The RFA shall be EBAA Iron Megaflange-Flange Adapter Series
2100 or Star Pipe Products StarFlange Series
3200.

F. Service Clamps: Service clamps shall be ductile iron, double strap clamps equal to Mueller.

2.03 Joints

A. General

1. Unless shown or specified otherwise, joints for buried service shall be push-on or restrained joint type for pipe and standard mechanical, push-on or restrained joints for fittings. Joints for exposed service shall be flanged for pipe and fittings, unless shown otherwise.

2. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.

3. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported nor by the environment in which the pipe is installed.

B. Push-On and Mechanical Joints

1. Joints shall conform to AWWA C111/ANSI A21.11. Bells shall be integrally cost with the pipe.

2. Bolts and nuts shall be Tee Head bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimension shown in AWWA C111/ANSI A21.11.

3. Gaskets shall be in accordance with AWWA C111/ANSI A21.11 and shall be constructed of Neoprene unless otherwise shown on the Drawings.

4. Mechanical joint glands shall be ductile iron.

C. Flanged Joints

1. Flanged joints shall conform to AWWA C115/ANSI A21.15. Flanges shall be ductile iron and shall be furnished by the pipe manufacturer.

2. Flanged joints shall be bolted with through stud or tap bolts of required size as directed. Bolt length and diameter shall conform to ANSI/AWWA C115 for Class 125 flanges shown in ANSI/ASME B16.1.

   a. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.

   b. Bolts for submerged service shall be stainless steel machine bolts conforming to ASTM A 193, Grade B8. Nuts shall be heavy hex, stainless steel conforming to ASTM A 194, Grade 8.

3. Gaskets shall be made of 1/8-inch thick, Neoprene. Gaskets may be ring type or full face type.

4. For 16-inch and larger flanged joints use gaskets equal to American Toruseal" or US Pipe "Flange Tyte".

5. Flanged ductile iron pipe shall have flanges cast solidly or threaded to the pipe barrel. Pipe threads shall be of such length that with flanges screwed home, the end of the pipe shall project beyond the face line of the flange. Flange and pipe shall then be machined to give a flush finish to the pipe and the flange and surface shall be normal to the axis of the pipe. Ductile iron flanges shall be of such design that the flange neck completely covers the threaded portion of the pipe to protect same against corrosion. All pipe with threaded type flanges shall be assembled, faced, and drilled at the point of manufacture, unless otherwise approved by the Engineer.

6. Flange filler shall conform to AWWA C110/ANSI A21.10. Joint bolt length shall be increased by the thickness of the flange filler.

7. Where tap or stud bolts are required, flanges shall be drilled and tapped accordingly.

D. Restrained Joints

1. Manufactured restrained joints shall be American, FLEX-RING or LOK-RING, U.S. Pipe TR FLEX.

2. Restraining gasket joints shall be assembled with ACIPCO American Fast-Grip gaskets or US Pipe FIELD LOK gasket.

3. No field welding of restraint pipe will be permitted.

4. Bolts, nuts and joint accessories shall be in accordance with manufacturer's recommendations.

5. Gaskets shall be in accordance with manufacturer's recommendation.

2.04 WALL SLEEVES AND WALL PIPES

A. Where piping passes through concrete structures, furnish and install wall sleeves unless wall pipes or other provisions are specifically shown on the Drawings.

B. Wall Sleeves

1. For pipe sizes smaller than 3-inches, wall sleeves shall be steel oversize sleeves furnished with a full circle, integral or continuously welded waterstop collar. The sleeve seal shall be the mechanically expanded, synthetic rubber type. Provide all associated bolts, seals and seal fittings, pressure clamps or plates necessary to achieve a watertight installation. Sleeves shall extend the full thickness of the concrete. Sleeves and seal shall be Link Seal.

2. For larger pipe sizes, wall sleeves shall be statically cast ductile iron mechanical joint wall sleeves. Unless specified or shown otherwise for a specific situation, wall sleeves shall be mechanical joint bell-plain end type with waterstop/thrust collar. Sleeves shall be constructed with studs and mechanical joint [retainer] gland on the air side of the concrete structure. Provide retainer gland where shown on the Drawings. Where the concrete structure is exposed to dirt on one side and is wet on the other side, construct with studs and glands on the dirt side.

C. Wall Pipes: Wall pipes shall be cast and/or fabricated and lined in one manufacturer's facility and delivered to the job site ready for use.

2.05 COATINGS

The exterior of pipe and fittings for buried service shall be factory coated with an asphaltic coating conforming to AWWA C151/ANSI 21.51 for ductile iron pipe, AWWA C115/ANSI 21.15 for flanged pipe and AWWA C110/ANSI 21.10 for fittings. Pipe and fittings which shall be exposed or submerged shall be factory coated with a general purpose rust inhibitive primer compatible with the type of paint which will be field applied in accordance with the requirements of Section 09900 of these Specifications.

2.06 LININGS

A. Pipe and fittings shall be cement lined in accordance with AWWA C104/ ANSI A21.4, standard thickness, unless specified or shown otherwise.

B. Special Lining

1. Where shown on Drawings or where specified, pipe and fittings shall be lined with ceramic epoxy as specified below.

2. Special linings shall cover all exposed surfaces of pipe and fittings subject to contact with sewer liquid or gas. The lining of the pipe barrel shall extend from spigot end through the socket to the edge of the gasket sealing area or recess for pipe using push-on gaskets, and to the edge of the gasket seat for mechanical joints. The lining shall also cover the exterior of the spigot end from the end of the pipe to beyond the gasket sealing area. The lining in fittings shall cover the interior surfaces including the socket areas as defined above. All linings shall be hermetically sealed at the ends.

C. Ceramic Epoxy Lining (all pipe diameters)

1. Lining Material: The lining material shall be Protecto 401 Ceramic Epoxy, an amine cured novalac epoxy containing at least 20 percent by volume of ceramic quartz pigment. The material shall meet the following minimum requirements:

a. A permeability rating of 0.00 when tested according to Method A of ASTM E-96-66, Procedure A with a test duration of 30 days.

b. The following test shall be run on coupons from factory lined ductile iron pipe:

i. ASTM B-117 Salt Spray (scribed panel) – Results to equal 0.0 undercutting after two years.

ii. ASTM G-95 Cathodic Disbondment 1.5 volts @ 77°F. Results to equal no more than 0.5 mm undercutting after 30 days.

iii. Immersion Testing rated using ASTM D-714-87.

a) 20% Sulfuric Acid – No effect after two years.

b) 140°F 25% Sodium Hydroxide – No effect after two years.

c) 160°F Distilled Water – No effect after two years.

d) 120°F Tap Water (scribed panel) – 0.0 undercutting after two years with no effect.

c. An abrasion resistance of no more than 3 mils (.075 mm) loss after one million cycles using European Standard EN 598: 1994 Section 7.8 Abrasion Resistance.

2. Surface Preparation: Surface preparation shall consist of the ductile iron surface to a near-gray blast finish. This degree of cleanliness is comparable to a SSPC-SP10 for steel with the exception that ductile iron attains a gray color when blast cleaned. The blast cleaning operation shall remove 95% of all surface contaminants, including tightly adhered annealing scale. The anchor tooth pattern, resulting from the blasting operation, shall have a minimum height of 3.0 mils.

3. Applicators: The lining shall be applied using a centrifugal lance applicator by applicators certified by the lining manufacturer. The workers shall be experienced and competent in the surface preparation, application and inspection of the lining to be applied.

4. Lining: After the surface preparation and within 8 hours of surface preparation, the interior of the pipe shall receive 40 mils nominal dry film thickness of Protecto 401. Minimum thickness shall be 30 mils. No lining shall take place when the substrate or ambient temperature is below 40 degrees Fahrenheit. The surface shall be dry and dust free. If flange pipe or fittings are lined, the lining shall not be used on the face of the flange.

5. Bell Sockets and Spigot Ends: The gasket area and spigot end up to 6 inches back from the end of the spigot end shall be coated with 6 mils nominal, 10 mils maximum, using Protecto Joint Compound. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be performed after the application of the lining.

6. 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. To prevent delamination between coats, no material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.

7. Touch-Up and Repair: Protecto Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.

8. Lining Holiday Test: At the manufacturer's facility, the lining shall be tested over 100% of the pipe barrel surface with a high-voltage spark tester as recommended by ASTM Designation G-62 Method B. If holidays are found in the lining by the above test at the manufacturing plant, the holiday shall be repaired per the lining manufacturer's recommendation. The holiday detector shall be a commercially available detector available from holiday detection equipment manufacturers such as SPY, TINKER AND RASOR, and ZORELCO.

9. All pipe linings shall be checked for thickness using a magnetic film thickness gauge. Thickness testing shall be performed in accordance with SSPC-PA-2.

10. Each pipe joint and fitting shall be marked with the date of application of the lining system and with the numerical sequence of application of that date.

11. Certification: The pipe or fitting manufacturer shall supply a certificate attesting to the fact that the applicator met the requirements of this Specification, and that the material used was as specified.

12. Handling: Protecto 401 lined pipe and fittings shall 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.

2.07 RETAINER GLANDS

Retainer glands for ductile iron pipe shall be Megalug Series 1100, as manufactured by EBAA Iron, Uni-Flange Series 1400, as manufactured by Ford Meter Box Company, or Star Pipe Products StarGrip Series 3000.

2.08 POLYETHYLENE ENCASEMENT

Ductile iron pipe shall be encased with polyethylene film where shown on the Drawings. Polyethylene film shall have a minimum thickness of 8 mils.

PART 3 EXECUTION

3.01 CUTTING

A. When new or existing pipe is required to be cut, the pipe shall be cut in such a manner as to leave a smooth end normal to the axis of the pipe.

B. All cutting of ductile iron pipe shall be performed with a cutting saw. All burrs shall be removed from the inside and outside edges of all cut pipe. All damaged linings and coatings shall be repaired.

C. Lining Repair: Repair epoxy linings and recoat spigot ends of cut pipe with Protecto 101 or Madewell 1104 coal tar epoxy in accordance with the manufacturer's recommendations and as specified below:

1. Remove all burrs and areas of loose lining materials by sanding or scraping to bare metal.

2. Remove oil and lubricants used during field cutting.

3. Lining shall be stripped back a minimum of 1-inch from the spigot end into well adhered lined areas.

4. Roughen 1 to 2-inches of good lining with a rough grade (40 grit) emery paper, rasp or small chisel, to allow an overlap between new and existing lining.

5. Apply lining repair material in the number of coats required to match the thickness requirements as specified in Part 2 of this Section and in accordance with the manufacturer's recommendations.

3.02 JOINT ASSEMBLY

A. General: Ductile iron pipe shall be assembled in accordance with ANSI/AWWA C600.

B. Push-On Joints: The inside of the bell and the outside of the pipe from the plain end to the guide stripe shall be wiped clean immediately before assembling the pipe joint. Then the rubber gasket shall be inserted into a groove or shaped recess in the bell. Both the bell and spigot ends to be joined shall be wiped again to ensure they are thoroughly clean. A liberal coating of special lubricant furnished by the pipe manufacturer shall be applied to the outside of the pipe. The plain end shall be centered in the bell and the spigot pushed home.

C. Mechanical Joints

1. The surfaces with which the rubber gasket comes in contact shall be brushed thoroughly with a wire brush just prior to assembly to remove all loose rust or foreign material which may be present and to provide clean surfaces which shall be brushed with a liberal amount of soapy water or other approved lubricant just prior to slipping the gasket over the spigot end and into the bell. Lubricant shall be brushed over the gasket prior to installation to remove loose dirt and lubricate the gasket as it is forced into its retaining space.

2. Joint bolts shall be tightened by the use of wrenches and to a tension recommended by the pipe manufacturer. When tightening bolts, the gland shall be brought up toward the pipe bell. If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning. Overstressing of bolts to compensate for poor installation shall not be permitted.

3. After installation, bolts and nuts in buried piping shall be given two heavy coats of a bituminous paint. Bolts and nuts for exposed or submerged service shall be coated in accordance with the requirements of Section 09900 of these Specifications.

D. Flanged Joints

1. All flanges shall be true and perpendicular to the axis of the pipe. Flanges

shall be cleaned of all burrs, deformations, or other imperfections before joining. Flanged joints shall be installed so as to ensure uniform gasket compression. All bolting shall be pulled up to the specified torque by crossover sequence. Where screwed flanges are used, the finished pipe edge shall not extend beyond the face of the flange, and the flange neck shall completely cover the threaded portion of the pipe.

2. Connections to equipment shall be made in such a way that no torque is placed on the equipment flanges. Connecting flanges must be in proper position and alignment and no external force may be used to bring them together properly.

3. Flanged filler shall be used only where shown on the Drawings or approved by the Engineer to make up minor differences in pipe length, less than 3-inches. Joint bolts shall be increased in length by the thickness of the flange filler.

3.03 DRILLING AND TAPPING

A. Wherever required ductile iron pipe and fittings shall be drilled and tapped to receive any other piping. All holes shall be drilled accurately at right angles to the axis of any pipe or fitting. Where plugs are drilled, holes shall be at right angles to the face of the plug.

B. Unless shown otherwise, small diameter pipes, less than 2-inches, shall be connected to ductile iron pipe using one of the following methods:

1. Direct tap.

2. Direct tap with service clamp.

3. Direct tap boss.

4. Tapped plug or flange on tapping saddle.

C. In no case shall the effective number of threads be less than 4.

3.04 CONSTRUCTING BENEATH AND BEYOND STRUCTURES

A. All ductile iron pipes entering buildings or basins shall be adequately supported between the structure and undisturbed earth to prevent damage resulting from settlement of backfill around the structure.

3.05 CONSTRUCTING WITHIN STRUCTURES

A. Proper and suitable tools and appliances for safe and convenient handling and laying of pipe and fittings shall be used. Care shall be taken to prevent the pipe coating from being damaged, particularly cement linings on the inside of the pipes and fittings. Any damage shall be remedied as directed by the Engineer.

B. All pipe and fittings shall be carefully examined by the **Contractor** for defects just before installing and no pipe or fitting shall be installed if it is defective. If any defective pipe or fitting is discovered after having been installed, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the **Contractor** at **Contractor's** own expense.

C. All pipes and fittings shall be thoroughly cleaned before they are installed and shall be kept clean until they are used in the completed work. Open ends of pipe shall be kept plugged with a bulkhead during construction.

D. All elbows, tees, brackets, crosses, and reducers in pressure piping systems shall be adequately restrained against thrust.

E. Wall pipe and wall sleeves shall be accurately located and securely fastened in place before concrete is poured. All wall pipe and sleeves shall have wall collars properly located to be in the center of the wall where the respective pipes are to be installed. Pipe passing through the sleeve shall extend no more than three feet beyond the structure without a piping joint.

F. Wall pipe and wall sleeves shall be constructed when the wall or slab is constructed. Blocking out or breaking of the wall for later installation shall not be permitted.

G. Cutting or weakening of structural members to facilitate pipe installation shall not be permitted. All piping shall be installed in place without springing or forcing.

3.06 FIELD PAINTING

Field painting of exposed and submerged pipe shall be in accordance with the requirements of Section 09900 of these Specifications.

3.07 INSPECTION AND TESTING

All testing shall be in accordance with the requirements of Section 02650 of these Specifications.

END OF SECTION

SECTION 02539
ABANDONMENT OF EXISTING FORCE MAINS

PART 1 - GENERAL

1.01 SCOPE

A. The work covered under this Section includes furnishing all labor and equipment required for abandonment of existing force mains and appurtenances, as shown on the Drawings and as specified herein.

B. Related Work specified elsewhere:

1. Section 02050 - Demolition
2. Section 02125 - Temporary and Permanent Erosion and Sediment Control
3. Section 02200 - Earthwork
4. Section 02920 - Site Restoration

1.02 SUBMITTALS

Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300 - Submittals. Prior to beginning work, the **Contractor** shall submit a schedule of demolition and detail methods to be used on each facility to be demolished.

1.03 QUALITITY ASSURANCE

Reference Standards: Comply with all Federal and State laws or ordinances, as well as all applicable codes, standards, regulations, and/or regulatory agency requirements, including the partial listing below:

A. CRD-C621 - U.S. Army Corps of Engineers Specification for Non-Shrink Grout
B. ASTM C150 - Standard Specification for Portland Cement
C. ASTM C33 - Standard Specification for Concrete Aggregates

PART 2 - PRODUCTS

2.01 GENERAL

A. Grout/Flowable Fill: Filling abandoned sewers shall conform to the requirements of a submittal approved by the **County**.

B. Crushed Stone Aggregate Backfill: Crushed stone aggregate backfill, as specified in Section 02060 - Crushed Stone Aggregate, shall be used where applicable for work described in this Section.

PART 3 - EXECUTION

3.01 INSPECTION

Abandoned force main lines shall be inspected prior to grout filling. Where indicated on the Plans or as directed by the **County**, the **Contractor** shall perform television inspection, smoke testing, and/or dye testing to determine whether there are active service connections. The **Contractor** shall not grout fill sanitary sewer lines with active connections. Inspection costs will be included as part of the grout filling or abandoning payment.

3.02 GROUT FILL OF ABANDONED FORCE MAINS

A. Flowable fill shall be pumped into the sewer line from the upstream end with sufficient pressure to ensure that the line is completely filled.

B. When manholes are to remain in service, care shall be taken to ensure that no grout enters sewer lines or manholes that are to remain in service. If required, the interior manhole surface shall be repaired using approved methods to a smooth consistent finish.

3.03 BACKFILL OF ABANDONED SANITARY SEWER MANHOLES

A. The **Contractor** shall remove the ring and cover and the manhole corbel/cone to a minimum depth of three (3) feet. All upstream and downstream pipes are to have a brick bulkhead and sealed at the manhole.

B. The **Contractor** shall backfill abandoned manholes with approved backfill material as directed by the **County**.

3.04 REMOVAL AND BACKFILL OF EXISTING FORCE MAINS

A. The **Contractor** shall completely remove sewer lines where indicated on the Plans or as directed by the **County**.

B. The **Contractor** shall backfill the trench in accordance with Section 02324 - Trenching and Backfilling, and as directed by the **County**.

3.05 REMOVAL AND BACKFILL OF EXISTING STRUCTURES

A. The **Contractor** shall completely remove structures where indicated on the Plans or as directed by the **County**.

B. The **Contractor** shall backfill the excavation with local earth backfill unless otherwise directed by the **County**.

3.06 CLEANUP

After the abandonment or removal work has been completed, the **Contractor** shall clean up the project area. All excess material and debris not incorporated into the Work shall be disposed of

by the **Contractor** in a lawful manner at the **Contractor's** cost. The site of the Work shall be left in a condition that is equal to or better than what existed prior to beginning the Work. Disturbed grassed areas shall be seeded or sodded. Site restoration shall be performed in accordance with the requirements of Section 02920 - Site Restoration.

+++ END OF SECTION 02539 +++

SECTION 02605
AIR/VACUUM RELEASE VALVES

PART 1 – GENERAL

1.1 DESCRIPTION

A. The WORK under this Section and the DeKalb County Department of Watershed Management Design Standards Manual includes providing all labor, materials, tools and equipment necessary for furnishing and installing air release valves with appurtenances.

1.2 SUBMITTALS

A. Air/Vacuum Release Valve: Catalogue cut.

1.3 QUALITY ASSURANCE

A. Manufacturer shall provide written certification that all equipment furnished complies with all applicable requirements of these specifications.

B. Valves shall be facility tested in compliance with applicable sections of the codes and standards.

1.4 WARRANTY

A. The equipment warranty shall be 100% parts and labor. Valves shall be free of defects in design, material, workmanship, and installation for a period of 24 months from the date of Owner acceptance. If any part of a valve should fail during the warranty period, it shall be replaced and restored to full and compliant service at no expense to the Owner.

PART 2 – PRODUCTS

2.1 MANHOLES

A. The manhole shall be a storm drain, Type I shallow manhole, unless otherwise shown on the Drawings

B. Manhole covers shall be embossed with the word “SEWER” in three (3) inch high letters.

2.2 PIPE

A. Connecting Pipe between the force main service saddle and the air release valve shall be hot-dip galvanized steel conforming to ASTM A 53, Schedule 40.

2.3 FITTINGS

A. Fittings for steel pipe shall be malleable iron threaded type with a working

pressure rating of 150 psi. Material shall conform to ASTM A 47, Grade 32510.

B. Fittings shall be hot-dip galvanized.

2.4 MISCELLANEOUS

A. The air release valve shall be a two-inch Vent-O-Mat Series RGXb-DN50, or approved equal.

B. The corporation stop shall be a Mueller H-10012 with lever handle, Ford F500 with lever handle, or approved equal.

C. The service saddle shall be a double strap, iron, I.P. thread, Rockwell 313, or approved equal.

D. The Sewerage Air Release and Vacuum Break Valve shall consist of a compact tubular all stainless steel fabricated body, hollow direct acting float and solid large orifice float in HDPE – stainless steel nozzle and woven dirt inhibitor screen, nitrile rubber seals and natural rubber seat.

E. The valve shall have an integral “Anti-Surge” Orifice mechanism which shall operate automatically to limit surge pressures or shock induced by liquid oscillation and/or rapid air/gas discharge to less than 1.5 x valve rated working pressure.

F. Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice nozzle on a natural rubber seal affixed into the control float. The nozzle shall have a flat seating land surrounding the orifice so that damage to the rubber seal is prevented.

G. The valve construction shall be proportioned with regard to material strength characteristics, so that deformation. Leaking or damage of any kind does not occur by submission to twice the designed working pressure.

H. Prior to the ingress of liquid into the valve chamber, as when the pipeline is being filled, valves shall vent through the “Anti-Surge” orifice when sewage approaches velocities are relative to a transient pressure rise, on valve closure, of <1.5 x valve rated pressure.

I. Valves shall not respond to the presence of air/gas by discharging it through the small orifice at any pressures within a specified design range, i.e., 0.5 bar to 10 bar and shall remain leak tight in the absence of air.

J. Valves shall not exhibit leaks or weeping of liquid past the large orifice seal at operating pressures of 0.5 bar to 1.5 x rated working pressure.

K. Valves shall react immediately to pipeline drainage or water column separation by the full opening of the large orifice so as to allow unobstructed air intake at the lowest possible negative internal pipeline pressure.

PART 3 – EXECUTION

3.1 CONSTRUCTION

A. All construction activities shall meet the quality requirements set forth in the applicable portions of these Specifications.

B. All piping shall be sloped to permit escape of any entrained air.

C. A field change in water pipe profile may require changing the location of the air release valve.

3.2 FIELD TESTS

A. Test all valves and appurtenances for proper operating adjustments and settings and for freedom from vibration, binding, scraping, and other defects. All defects found shall be corrected or approved.

END OF SECTION

SECTION 02607
MANHOLES, JUNCTION BOXES, CATCH BASINS AND INLETS

PART 1 - GENERAL

1.01 SCOPE

A. Work described in this Section includes furnishing all labor, materials, equipment, tools, and incidentals required to install cast-in-place and precast concrete manholes, junction boxes, catch basins, and inlets. The term manholes, as used herein and shown on the Drawings, includes manholes, junction boxes, catch basins, and inlets. All Work shall be installed, adjusted, tested, and placed in operation in accordance with these Specifications, the manufacturer's recommendations, and as shown on the Drawings.

B. Related Work Specified Elsewhere:

1. Section 02200 - Earthwork
2. Section 03200 - Concrete Reinforcement and Dowelling
3. Section 03300 - Cast-In-Place Concrete

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300. In addition, the following specific information shall be provided:

1. Complete shop drawings and engineering data on frames, covers, steps, and precast manhole sections and flotation calculations shall be submitted to the **County** in accordance with the requirements of the General Requirements of the Contract Documents.

1.03 QUALITY ASSURANCE

A. Prior to delivery, all basic materials specified herein shall be tested and inspected by an approved independent commercial testing laboratory or, if approved by the **County**, certified copies of test reports prepared by the manufacturer's testing laboratory will be acceptable. All materials that fail to conform to these Specifications shall be rejected.

B. After delivery to the site, any materials that have been damaged in transit or are otherwise unsuitable for use in the Work shall be rejected and removed from the site.

1.04 QUALITY STANDARDS

A. Manufacturers offering products that comply with these specifications include:
1. Standard manhole frame and cover
a. Vulcan Foundry, VM-26

b. Neenah Foundry, Series R-1700
c. Or Approved Equal

2. Manhole adjusting rings
   a. Neenah Foundry, R1979-H
   b. Higgins Foundry
   c. Or approved equal

3. Manhole rungs
   a. M.A. Industries
   b. Or Approved Equal

1.05 WARRANTY

A. Provide a manufacturer's warranty against defective materials and workmanship in accordance with the requirements of the General Requirements of the Contract Documents.

PART 2 - PRODUCTS

2.01 GENERAL

A. Manholes shall be constructed of specified materials to the sizes, shapes, and dimensions and at the locations shown on the Drawings or as otherwise directed by the **County**. The height or depth of the manhole will vary with the location, but unless shown otherwise on the Drawings, shall be such that the top of the manhole frame will be at the finished grade of the pavement or ground surface and the invert shall be at the designated elevations.

2.02 MATERIALS AND CONSTRUCTION

A. Concrete and Reinforcement:

1. Concrete used in manhole and junction chamber construction shall be Class "A" concrete conforming to the requirements of Section 03300 – Cast-In-Place Concrete.

2. Steel reinforcement shall conform to the requirements of Section 03200 – Concrete Reinforcement and Dowelling.

3. Brick: The brick shall conform to the requirements of AASHTO M 91.

4. Mortar: The mortar for brick masonry and similar Work shall be composed of one (1) part of Portland cement and two (2) parts of mortar sand, by volume. The Portland cement shall conform to the requirements of AASHTO M 45. Hydrated lime may be added to the mixture of sand and cement in an amount not to exceed fifteen (15) percent of the weight of cement used. The hydrated lime shall meet the requirements of ASTM C 6. The water shall be clean and free of deleterious amounts of acids, alkalis, or organic material. If the water is of questionable quality, it shall

be tested in accordance with AASHTO T 26.

B. Precast Concrete Manholes:

1. Precast concrete manholes shall consist of precast reinforced concrete sections, a conical or flat slab top section, and a base section conforming to the typical manhole details as shown on the Drawings.

2. Precast manhole section shall be manufactured, tested, and marked in accordance with the latest provisions of ASTM C 478.

3. The minimum compressive strength of the concrete for all sections shall be four thousand (4,000) psi.

4. The maximum allowable absorption of the concrete shall not exceed eight (8) percent of the dry weight.

5. The circumferential reinforcement in the riser sections, conical top sections and base wall sections shall consist of one (1) line of steel and shall be not less than seventeen hundredths (0.17) square inches per lineal foot.

6. The ends of each reinforced concrete manhole riser section and the bottom of the manhole top section shall be so formed that when the manhole risers and the top are assembled, they will make a continuous and uniform manhole.

7. Joints of the manhole sections shall be of the tongue and groove type. Sections shall be joined using 0-ring rubber gaskets conforming to the applicable provisions of ASTM C443, latest revision, or filled with an approved preformed plastic gasket meeting the requirements of Federal Specifications 55-5-00210, "Sealing Compound, Preformed Plastic for Pipe Joints", Type 1, Rope Form.

8. Each section of the precast manhole shall have not more than two (2) holes for the purpose of handling and laying. These holes shall be tapered and shall be plugged with rubber stoppers or mortar after installation.

9. Polypropylene plastic manhole steps shall be installed in each section of the manhole in accordance with the **County** standard details.

C. Not Used

D. Frames and Covers:

1. Frames and covers shall be cast iron conforming to the minimum requirements of Federal Specifications WWOI-652 or to ASTM A 48 for Class 30 Gray Iron Castings. All castings shall be made accurately to the required dimensions, interchangeable, sound, smooth, clean, and free

from blisters and/or other defects. Defective castings that have been plugged or otherwise treated shall not be used. All castings shall be thoroughly cleaned and painted or coated with a bituminous paint. Each casting shall have its actual weight in pounds stenciled or painted on it in white paint.

2. Standard manhole frames and covers shall have a minimum of twenty-two (22) inches clear inside diameter and shall be a minimum of five (5) inches high, with guide ring, and shall weigh not less than four hundred, forty-six (446) pounds, total. Manhole covers shall be as detailed on the Drawings.

3. The contact surfaces of all manhole covers and the corresponding supporting rings in the frames shall be machined to provide full perimeter contact.

4. All sanitary sewer manhole covers shall have the word "PROPERTY OF DEKALB COUNTY" cast on the top in letters two (2) inches high.

5. An adjusting ring shall be provided for each manhole in a street.

6. Provide solid manhole and handhole covers and frames for electrical underground systems. Covers shall have letters "HIGH VOLTAGE," "LOW VOLTAGE," "SIGNAL," as applicable, embossed on top.

PART 3 - EXECUTION

3.01 CONSTRUCTION OF CAST-IN-PLACE CONCRETE MANHOLES

A. Cast-in-place manholes, excluding curved manhole bases, shall be constructed in place with the base, barrel, and conical section all monolithically cast using removable forms of material and design approved by the **County**.

B. The vertical forms, vertical and horizontal wall spacers, steps, and placing cone shall be carefully positioned and firmly clamped in place before any placement is made. The wall spacers shall be located ninety (90) degrees from each other. The forms shall be firmly supported with bottom of forms at the proper elevation to permit the base to be deposited through the vertical forms.

C. No pipe penetration shall be formed within twelve (12) inches of a corner, on square bases, or within twelve (12) inches of another penetration, in any direction, for circular bases.

D. The manhole base shall be deposited down through the wall forms onto undisturbed earth or shall be rock bearing. It shall be evenly distributed around the walls and vibrated both inside and outside the forms until there is a minimum slope of sixty (60) degrees from the bottom of the forms to the bearing surface both inside and outside of the manhole. When this is complete and before additional concrete is added, the concrete shall be carefully vibrated on each side of each

sewer pipe.

E. The base shall be concentric with the manhole, except where eccentric alignment with ladder is required, and have a minimum diameter of four (4) feet or sixteen (16) inches greater than the outside diameter of the manhole whichever is greater, and ten (10) inch minimum thickness under the lowest pipe. Minimum wall thickness shall be six (6) inches.

F. Additional concrete shall be deposited in evenly distributed layers of approximately eighteen (18) inches with each layer vibrated to bond it to the preceding layer. The wall spacers shall be raised as the placements are made. The concrete in the area from which the spacer is withdrawn shall be carefully vibrated. Excessive vibration shall be avoided.

G. Adjustment rings shall be provided between the conical section and the manhole frame. The rings shall be cast-in-place using building felt between pours to create a weakened joint or as directed by the **County**. If adjustment of the lid elevation is called for, concrete adjusting rings shall be used.

H. All manhole bases, including curved manhole bases and inverts shall be constructed of Class "A" concrete in accordance with details on the Drawings. Inverts shall be smooth and accurately shaped and have the same cross section as the invert of the sewers that they connect. The manhole base and invert shall be carefully formed to the required size and grade by gradual and even changes in sections, care being exercised to form the incoming and outgoing sewer pipes into the wall of the manhole at the required elevations. Changing directions of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit. The invert and flow channel shall be formed during or immediately after the placing of the concrete and brush-finished as soon as the concrete has sufficiently set.

I. Form marks and offsets shall not exceed one (1) inch on the outside surface of the manhole. Form marks and offsets shall not exceed one-half (1/2) inch inside of the manhole. All offsets on the inside surface of the manhole shall be smoothed and rubbed so there is no projection or irregularity capable of scratching a worker or catching and holding water or other materials. Honeycombed areas shall be completely removed immediately upon removal of the forms and replaced with a Class "A" concrete as directed by the **County**, or patched with epoxy grout.

J. Should circumstances make a joint necessary, a formed groove or reinforcing dowels shall be required in the top of the first placement for shear protection. Immediately before the second placement is made, the surface of the cold joint shall be thoroughly cleaned and wetted with a layer of mortar being deposited on the surface.

K. Concrete setting time and backfilling shall be in accordance with the applicable requirements of Section 03300 - Masonry Work shall be allowed to set for a period of not less than twenty-four (24) hours. Outside forms, if any, then shall be removed and the manhole backfilled and compacted. All loose or waste material shall be removed from the interior of the manhole. The manhole cover then shall

be placed and the surface in the vicinity of the Work cleaned off and left in a neat and orderly condition.

3.02 CONSTRUCTION OF PRECAST CONCRETE MANHOLES

A. After placing a manhole base, inverts shall be constructed using Class "A" concrete and three to five (3 to 5) inches slump range in accordance with details on the Drawings and inverts shall have the same cross section as the invert of the sewers that they connect. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in directions of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit.

B. After the base section has been set, and inverts formed, the precast manhole sections shall be placed thereon, care being exercised to form the incoming and outgoing sewer pipes into the wall of the manhole at the required elevations.

C. The cast iron frame for the manhole cover shall be set at the required elevation and properly anchored to the riser section. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted to conform to the exact slope, crown, and grade of the existing adjacent pavement.

D. After backfilling has been completed, the excavated area, if located in a street, alley, or sidewalk, shall be provided with a temporary surface.

3.03 MANHOLES OVER EXISTING SEWERS

A. Construct manholes over existing operating sewer lines at locations shown. Perform necessary excavation as specified hereinbefore, support precast concrete MH base over existing pipe on brick or solid concrete block then pour concrete slab base, break into existing line, construct riser sections, and complete Manhole construction.

B. Maintain flow through existing sewer lines at all times, and protect new concrete and mortar Work for a period of seven (7) days after concrete has been placed. Advise **County** of plans for diverting sewage flow and obtain **County's** approval before starting. **County's** approval shall not relieve **Contractor** of responsibility for maintaining adequate capacity for flow at all times and adequately protecting new and existing work.

C. Construct the new base under the existing sewer and the precast sections as specified herein.

D. Break out the existing pipe within the new manhole, cover the edges with mortar, and trowel smooth. Gain approval from the **County** prior to breaking out the existing pipe.

3.04 INSPECTION AND TESTING

A. After completion, all manholes shall be inspected. The **Contractor** shall make, at

Contractor's expense, all necessary changes, modifications, and/or adjustments required to assure satisfactory operation.

+++END OF SECTION 02607+++

SECTION 02624
HIGH DENSITY POLYETHYLENE PIPE

PART 1 - GENERAL

1.01 SCOPE

A. This Section includes furnishing all labor, materials, pipe, fittings, butt fusion, and incidentals required for installing a complete, leak-free high density polyethylene (HDPE) pipe. All piping under this section shall be installed and tested in accordance with these Specifications, the manufacturer's recommendations, and the DeKalb County Department of Watershed Management Design Standards Manual.

B. Related Work
Division 3 - Concrete

1.02 SUBMITTALS

A. Submittals shall be made in accordance with Section 01300 - Submittals. Information to be submitted includes the following:

1. Manufacturer's Certification: Certify that products meet or exceed specifications
2. Manufacturer's Quality Control Manual
3. Shop Test Results
4. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories
5. Installation Instructions
6. Field Test Results

1.03 QUALITY ASSURANCE

A. Reference Standards. Comply with all Federal and State Laws, as well as the latest editions of the applicable codes, standards, regulations, or regulatory agency requirements including the following:

1. Plastics Pipe Institute, PPI

a. PPI Handbook of Polyethylene Pipe – 2009 (2nd Edition)

b. PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe

c. PPI Material Handling Guide for HDPE Pipe and Fittings

d. PPI TR-38 Bolt Torque for Polyethylene Flanged Joints

e. PPI TN-42 Recommended Minimum Training Guidelines for PE Pipe Butt

Fusion Joining Operators for Municipal and Industrial Projects

f. PPI TR-46 Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe

2. ASTM

a. ASTM D 638 Test for Tensile Properties of Plastics.

b. ASTM D 790 Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

c. ASTM D 1239 Test Method for Flow Rates of Thermal Plastics by Extrusion Plastometer.

d. ASTM D 1248 Specification for Polyethylene Plastics Molding and Extrusion Materials.

e. ASTM D 1505 Test Method for Density of Plastics by the Density Gradient. Technique.

f. ASTM D 1599 Test Methods for Short Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.

g. ASTM D 1693 Test Methods for Environmental Stress Cracking of Ethylene Plastics.

h. ASTM D 2122 Method for Determining Dimensions of Thermal Plastic Pipe

i. ASTM D 2837 Method for Obtaining Hydrostatic Design Basis for Thermal Plastic Pipe Materials.

j. ASTM D 3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

k. ASTM F 1248 Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe.

l. ASTM D 4219 Test Method for Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

m. ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

n. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

o. ASTM D 2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter- Controlled Polyethylene Pipe and Tubing

p. ASTM D 2737 Standard Specification for Polyethylene (PE) Plastic Tubing

q. ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping

r. ASTM F 2880 Standard Specification for Lap-Joint Type Flange Adapters for Polyethylene Pressure Pipe in Nominal Pipe Sizes 3⁄4 in. to 65 in.

s. ASTM D 3035 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter

t. ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

u. ASTM F 585 Standard Guide for Insertion of Flexible Polyethylene Pipe Into Existing Sewers

v. ASTM F 905 Standard Practice for Qualification of Polyethylene Saddle-Fused Joints

w. ASTM F 1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and

x. ASTM F 1290 Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings

y. ASTM F 1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

z. ASTM F 1962 Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles

B. Quality and Workmanship

1. The pipe and fitting manufacturer's production facilities shall be open for inspection by the **County** during normal working hours. During inspection, the manufacturer shall demonstrate that the facilities are capable of manufacturing the pipe and fittings required by this specification, that a quality control program meeting the minimum requirements of D3035, and ASTM F-714 is in use, and that facilities for performing the tests required by this specification are in use.

2. The **County** shall request certification that the pipe produced is represented by the quality assurance data. Additionally, test results from the manufacturer's testing that show the pipe does not meet appropriate ASTM standards of manufacturer's representation, shall be cause for rejection of the pipe represented by the testing. These tests may include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D 3350, 10.1.9.

3. The **County** shall request certified lab data from the manufacturer to verify the physical properties of the materials supplied under this specification or at manufacturer's expense, the **County** may take random samples for testing by an independent laboratory.

C. QA Deviations: Notify the **County** if an approved supplier is supplying material that does not meet all of the requirements of this specification. Submit a written description of any deviation, the justification for such deviation(s) and the worst case, long term impact of the deviation on the project. The **County** shall decide if the material is acceptable. In the event that the **County** rejects the deviation(s), the **Contractor** shall procure acceptable products at no additional cost to the **County**.

D. QA Rejection: Polyethylene pipe and fittings shall be rejected in whole or in part by the **County** for failure to meet any of the requirements of this specification.

E. QA Records: QA/QC records shall be maintained intact for a minimum of one (1) year from the date of production.

F. Construction Practice: Construction and installation shall be performed in compliance with the manufacturer's Design Guidelines and Installation Guidelines, and this specification.

1.04 DELIVERY, STORAGE, AND HANDLING

A. The manufacturer shall secure the piping such that shifting of the load in transit is not possible. The piping shall be covered for protection against weather and debris.

B. The **Contractor** and the **County** shall inspect the pipe for defects prior to acceptance. Any segments found to be damaged or unusable shall be returned to the manufacturer and replaced by new segments at no additional cost to the **County**.

C. The **Contractor** shall store the piping in an area not subject to regular traffic and out of direct exposure to sunlight. Any segments found damaged during installation shall be replaced by new segments at no additional cost to the **County**.

1.05 WARRANTY

A. The manufacturer shall provide a two (2) year warranty against defects in material and workmanship of all pipe segments.

B. The installation **Contractor** shall provide a three (3) year warranty against leakage at any joint.

PART 2 - PRODUCTS

2.01 PIPE, FITTINGS, AND SPECIALS

A. Typical Physical Properties

Property	Specification	Units	Nominal Values
Material Designation	PPI/ASTM	-	PE4710
Material Classification	ASTM D-1248	-	III C 5 P34
Cell Classification	ASTM D-3350	-	445474C
Density (4)	ASTM D-1505	gm/cm^3	0.955
Melt Flow (4)	ASTM D-1238	gm/10 min	0.15 kg
Flex Modulus (5)	ASTM D-790	psi	110,000 – 180,000
Tensile Str. (4)	ASTM D-638	psi	3000 – 3500
ESCR (3)	ASTM D-1693	F_o, Hrs	F_o> 5000
HDB @ 73 °F (4)	ASTM D-2387	psi	1600
U-V Stabilizer (C)	ASTM D-1603	%C	2% minimum
Hardness	ASTM D-2240	Shore “D”	64
Compressive Strength (Yield)	ASTM D-695	psi	1600
Tensile Strength @ Yield (Type IV Spec.)	ASTM D-638 (2"/min)	psi	3200
Elongation @ Yield	ASTM D-638	%, minimum	8
Tensile Strength @ Break (Type IV Spec.)	ASTM D-638	psi	3000 – 3500
Elongation @ Break	ASTM D-638	%, minimum	750
Modulus of Elasticity	ASTM D-638	psi	130,000
ESCR: Cond A, B, C: Mold. Slab)	ASTM D-1693	F_o, Hrs	F_o>5000
Compressed Ring (Pipe)	ASTM F-1248	F_{50}, Hrs	F_{50}>1000
Slow Crack Growth	ASTM F-1473	Hrs	500 minimum
Impact Strength (IZOD) (.125" THK)	ASTM D-256 (Method A)	In-lb/in Notch 42	
Linear Thermal Expansion Coefficient.	ASTM D-696	in/in/°F	1.2 X 10^4
Thermal Conductivity	ASTM C-177	BTU-in/ ft^2/hrs/°F	2.7
Brittleness Temp.	ASTM D-746	°F	<-180
Vicat Softening Temp.	ASTM D-1525	°F	+257
Heat Fusion Cond.	-	psi @ °F	75 @ 400°F
NSF Listing	Standard #14	-	“Listed”

Materials used for the manufacture of polyethylene pipe and fittings shall be extra high molecular weight, high density ethylene/hexene copolymer PE4710 polyethylene resin meeting the above listed physical property and pipe performance requirements:

1. The manufacturer shall provide certification that stress regression testing has been performed on the specific product. The said certification shall include a stress life curve per ASTM D-2837. The stress regression testing shall have been done in accordance with ASTM D2837, and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDR) of two hundred (200) psi, as determined in accordance with ASTM D 2837. The polyethylene pipe shall be provided with a minimum pressure safety factor of two hundred (200) percent.

2. The material shall be listed by PPI (the Plastics Pipe Institute, a division of the Society of the Plastics Industry) in PPI TR-4 with a seventy-three (73) ºF hydrostatic design stress rating of eight hundred (800) psi, and a one hundred forty

(140) degrees F hydrostatic design stress rating of four hundred (400) psi. The PPI Listing shall be in the name of the pipe manufacturer, and shall be based on ASTM D 2837 and PPI TR-3 testing and validation of samples of the pipe manufacturer's production pipe.

3. The manufacturer's certification shall state that the pipe was manufactured from one specific resin in compliance with these specifications. The certificate shall state the specific resin used, its source, and list its compliance to these specifications.

B. Pipe Extrusion

1. The pipe shall be extruded using a melt homogenizing/plasticating extruder and "appropriate" die. The extruder screw design shall be customized for the HDPE being processed to minimize melt fracture of the molecular structure thus reducing the molecular weight and changing some physical properties from resin to pipe. The resin shall be processed at its melt temperature of three hundred seventy-five (375) degrees F to four hundred twenty-five (425) degrees F. The extruded tubular melt shall be vacuum or pressure sized in downstream cooling tanks to form round pipe to specification diameter and wall thickness with a "matte-finish" surface.

C. Pipe

1. Pipe supplied under this specification shall have a nominal IPS (Iron Pipe Size) OD unless otherwise specified. The SDR (Standard Dimension Ratio) shall be a minimum of DR 11, the pressure rating of the pipe supplied shall be a minimum of 200 psi, the outside diameter shall be 8", and the wall thickness shall be 0.823".

2. The pipe shall be produced with the nominal physical properties outlined in Section 2.1(A), and to the dimensions and tolerances specified in ASTM F-714. Additionally, the pipe shall be inspected per industry accepted manufacturer standards for:

* Diameter
* Wall Thickness
* Concentricity
* Quick Burst Pressure and Ductility
* Joint Strength
* Straightness
* Ovality
* Toe-In
* Overall Workmanship
* Inspection on ID & OD
* Print Line

3. The pipe shall contain no recycled compound except that generated in the Manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogenous throughout and free of visible cracks, holes, voids, foreign inclusions, or other deleterious defects, and shall be identical in color, density, melt index, and other physical properties throughout.

4. Color

a. Inside: Inner wall shall be light color interior (soft gray or white).

b. Outside: Outer wall black with co-extruded green cover or extruded green

stripes designating use for sanitary sewer. Pipe with extruded green stripes shall have a minimum of three equally spaced stripes. Pipe shall have a heat indented print line containing the information required in ASTM D3035. Color print lines are not an acceptable method for designation of sewer mains.

D. Pipe Performance

1. The pipe shall be in compliance with the physical and performance requirements of Section 2.1(A) of this specification. Specifically, the pipe shall be extruded from resin meeting specifications of ASTM D 3350 with a cell classification of PE:445474C; and ASTM D-1248 pipe grade resin type III, Class C, Category 5, grade P34 polyethylene compound. The pipe shall exhibit the short-term tensile and compressive physical properties listed in Section 2.1(A). The pipe shall provide the long-term endurance characteristics recognized by: the compressed pipe ring environmental stress crack resistance greater than one thousand (1,000) hours; the slow crack growth resistance greater than five hundred (500) hours; the impact strength (toughness) greater than forty-eight (48) in-lb/in notch; and rotary fatigue endurance at ± (one thousand, six hundred (1,600) psi bending stress with F_o> two thousand (2,000) cycles.

E. HDPE Fittings

1. Butt Fusion Fittings- Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2.01.A. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans or accepted by the **County**/engineer. All fittings shall meet the requirements of AWWA C901 or C906.

   a. Molded fittings shall comply with the requirements of ASTM D 3261.

   b. All fabricated elbows, tees, reducing tees and end caps shall be produced and meet the requirements of ASTM F 2206, as manufactured by ISCO Industries, Inc or other approved manufacturer holding an ISO 9001 quality system certificate. Each fitting will be marked per ASTM F 2206 section 10 including the nominal size and fitting EDR, which will meet or exceed the pipe DR 11 identified for the project. Fabricated fittings shall be manufactured using a DataLogger to record fusion pressure and temperature, and shall be stamped with unique joint number that corresponds to the joint report. A graphic representation of the temperature and pressure data for all fusion joints made producing fittings shall be maintained for a minimum of 5 years as part of the quality control and will be available upon request of the **County**. Test results to validate ASTM F 2206 section 7.3 and 9 shall be provided to the **County** or the **County's** representative upon request.

   c. Socket fittings shall meet ASTM D 2683.

2. Electrofusion Fittings - Fittings shall be made of HDPE material with a minimum

material designation code of PE 4710 and with a minimum Cell Classification as noted in 2.01.A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans. For potable water systems, all electrofusion fittings shall have AWWA approval

3. Bolted Connections – Flanged and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206. Flanges and MJ Adapters shall be fused onto the pipe and have a minimum pressure rating equal to or greater than the pipe unless otherwise specified on the plans.

   c. Flange Adapters shall meet the dimensional and material requirements of ASTM F 2880.

   d. Metallic back-up rings (Van-Stone style lap joint flanges), shall have a radius on the inside diameter of the bore so as to be compatible with HDPE Flanges. Back up rings shall have bolt pattern that will mate with AWWA C207 Class D (or B or E), ASME/ANSI B 16.5 Class 150, ASME/ANSI B 16.1 Class 125, or ASME/ANSI B16.47 Series A.

   e. Flange assemblies shall be assembled and torqued according to PPI TN-38, "Bolt Torque for Polyethylene Flanged Joints."

   f. Where shown on the drawings, 4" and larger transitions to mechanical joint fittings and valves shall be accomplished using a MJ Adapter with kit. The D.I./HDPE mechanical joint adaptor shall consist of:
      i. A molded or fabricated HDPE mechanical joint transition fitting.
      ii. A rubber gasket.
      iii. A mechanical joint backup drive ring.
      iv. Corten mechanical joint tee bolts.

4. Mechanical Fittings: The use of mechanical coupling and saddles shall be approved by the **County** or engineer prior to installation. Mechanical Fittings shall be designed for use and compatible with HDPE pipe. Mechanical fittings shall have a pressure rating equal to or greater than the pipe.

   a. Couplings without self-restraining capabilities (integrated serrated teeth or grippers) shall include a plan for external restraint or isolation from pipeline generated forces.

   b. Mechanical Saddles shall have wide straps for distribution of clamping loads. No U- bolts shall be allowed.

   c. When required by mechanical coupling manufacturer, pipe stiffeners shall be employed to support the interior wall of the HDPE. The stiffeners shall support the pipe's end and control the "necking down" reaction to the pressure applied during normal installation. The pipe stiffeners shall be formed of 304 or 316 stainless steel, with a wedged style design to fit the HDPE manufacturers published average inside diameter of the specific size and DR of the HDPE.

F. Fusion Unit Requirements

1. All Fusion Equipment, whether new or used, rented or owned, shall comply with the requirements of ISO 12176-1 “Equipment for Fusion Jointing Polyethylene Systems”.

2. Butt fusion equipment must be in satisfactory working order and the hydraulic system must be leak free. Heater plates shall be free from scrapes, gouges, and have a consistent clean coated surface. The pressure gage and thermometer should be checked for accuracy. When requested by the County, records showing a maintenance service/inspection within 3 months prior to use for this project shall be provided.

3. Electrofusion Processors shall be maintained and calibrated per manufacturer’s requirements and recommendations.

G. Approved Suppliers

1. All Pipe, Fittings, and Fusion Equipment shall be provided by one supplier. Approved suppliers are ISCO Industries, Inc., Performance Pipe, JM Eagle, or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect each pipe and fitting before installation. Remove defective pipe. Replace with sound pipe.

3.02 PREPARATION

A. Pipe Packaging, Handling, Storage

1. The manufacturer shall package the pipe in a manner designed to deliver the pipe to the project neatly, intact, and without physical damage. The transportation carrier shall use appropriate method and intermittent checks to insure the pipe is properly supported, stacked, and restrained during transport such that the pipe is not nicked, gouged, or physically damaged.

2. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer’s recommendations. The handling of the pipe shall be done in such a manner that it is not damaged by dragging over sharp objects or cut by chokers or lifting equipment. Provide temporary shading. Covering causing temperature build-up is not acceptable.

3. Sections of pipe with cuts or gouges in excess of ten (10) percent of the wall thickness of the pipe shall be cut out and removed. The undamaged portions of the pipe shall be rejoined using the butt fusion joining method.

4. Fused segments of pipe shall be handled so as to avoid damage to the pipe. Nylon

lifting slings are preferred. Spreader bars are recommended when lifting long fused sections. Care shall be exercised to avoid cutting or gouging the pipe.

3.03 INSTALLATION

A. Joining

1. Sections of polyethylene pipe shall be joined above ground into continuous lengths at the job site. The joining method shall be the butt fusion method and shall be performed in strict accordance with the manufacturer's recommendations. The butt fusion equipment used in the joining procedures shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of four hundred (400) degrees F, alignment, and seventy-five (75) psi interfacial fusion pressure.

2. Butt fusion joining shall be one hundred percent (100%) efficient offering a joint weld strength equal to or greater than the tensile strength of the pipe. Flanges, unions, grooved-couplers, transition fittings, and some mechanical couplers may be used to mechanically connect HDPE where approved in writing by the **County**.

B. The **Contractor** shall use factory-trained technicians to perform all butt welding. All installation technicians shall have installed HDPE pipe for a minimum of two (2) years.

3.05 TESTING

A. The **Contractor** shall insure testing can be accomplished in a safe manner, including protection of personnel, equipment, and public in the event of a failure during testing. The **Contractor** shall restrain pipe, components, and test equipment as required. All pumps, valves, temporary connections, meters, gauges and other measuring devices shall be furnished, installed and operated by the **Contractor** and all such equipment and devices and their installation shall be approved by the **County's** Engineer.

B. The pressure gauges or data recorders should be calibrated and sufficiently sized to provide mid- range data (pressure tested will not be below 10% or greater than 90% of gauge capacity) that result in easy reading, interpretation. Gauges shall be accurate to within 2% of full scale with increments no greater than 10 psi.

C. The test pressure may be up to 1.5 times the FM pressure class, based on the lowest point in elevation in the test section.

D. Test pressures require consideration of thermal conditions. Polyethylene piping materials are typically pressure rated at 73°F (23°C) and PE piping at temperatures greater than 80°F (26°C) require reduced test pressures. (Note that higher pipe temperatures should consider both ambient temperatures and radiant solar heating of exposed black HDPE pipe) Guidance for elevated temperatures can be found in the appendix of Chapter 3 (Material Properties) of the PPI Handbook of PE Pipe.

E. Pressure Pipelines-Pressure testing shall be conducted in accordance with requirements and recommendations of ASTM F 2164 (Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure), AWWA M55 Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition). Pneumatic (compressed air) leakage testing of HDPE pressure piping is prohibited for safety reasons.

1. The section of pipe to be tested shall be filled with potable or generally clean water (uncontaminated river/lake water) approved by the **County**/Engineer. While the system is being filled with water, air shall be carefully and completely exhausted.

2. If the **Contractor** elects to perform hydrostatic testing against valves in an existing system, it does so at his own risk and will bear the cost of any damages to the existing valve, piping system, private or public property, or the new pipeline under test.

3. The test procedure for HDPE pipe consists of two steps: 1) the initial phase or expansion phase and 2) the test phase. During the initial/expansion phase, sufficient make-up water shall be added hourly for 3 hours to return to the test pressure. During the test phase, the expansion phase pressure is reduced by 10 psi to test phase pressure and monitored for at least one hour (3 hours maximum).

4. Under no circumstances shall the total time under test exceed eight (8) hours. If the test is not completed due to leakage, equipment failure or any other reason, depressurize the test section and permit the system to "relax" for eight (8) hours prior to the next testing sequence.

5. In accordance with section 9.8 of ASTM F 2164, the pipe shall pass if the final pressure is within 5% of the test phase pressure for the testing period (3 hours maximum). If the test section fails this test, the **Contractor** shall repair or replace all defective materials and/or workmanship at no additional cost to the **County**.

6. All pumps, gauges, and measuring devices shall be furnished, installed and operated by the **Contractor** and all such equipment and devices and their installation shall be approved by the **County**. All pressure and leakage testing shall be done in the presence of the **County**

7. The pipe shall be filled with water and subjected to a sustained pressure of one hundred fifty (150) pounds per square inch. While the system is being filled, air shall be carefully and completely exhausted. If permanent air vents are not located at all high points, the **Contractor** shall install corporation stops or fittings and valves at such points so the air can be expelled as the pipe system is slowly filled with water.

8. Rate of loss shall not exceed that specified in the following paragraph "Allowable Limits For Leakage". Visible leaks shall be corrected regardless of total leakage shown by test.

9. The Developer/Contractor shall furnish the water necessary for flushing/testing of the main. The Contractor shall provide the means necessary to convey the water from a designated source to the main, or rent a Fire Hydrant Meter to draw water from a County fire hydrant into a water tanker to be used for pressure testing. To rent a fire hydrant meter, call DCDWM at (404) 378-4475 for information.

B. Allowable Limits for Leakage

1. The hydrostatic pressure tests shall be performed to AWWA C-600 standards to ± five (5) psi as herein above specified and no installation, or section thereof, shall be acceptable until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = SD\frac{\sqrt{P}}{133200}$$

in which,

L = Allowable leakage, in gallons per hour
S = Total linear feet of pipe tested
D = Pipe diameter; in inches
P = Average test pressure during the test, in psi gauge

2. Water shall be supplied to the main during the test period as required to maintain the test pressure as specified. The quantity used, which shall be compared to the above allowable quantity, shall be measured by pumping from a calibrated container.

3. Other means of testing may be requested in writing to the **County** for approval.

3.06 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed under provisions of paragraph 3.05 or as approved by the **County**.

B. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest at no cost to **County**.

3.07 TRANSPORTATION, UNLOADING, AND STORAGE

A. The manufacturer shall package product in a manner designed to deliver the pipe and fittings to the project neatly, intact and without physical damage. During transportation each pipe shall rest on suitable pads, strips skids, or blocks securely wedged or tied in place.

B. During loading, transportation, and unloading, every precaution should be taken to prevent damage to the pipe. The handling of the pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Cuts or gouges that reduce the wall thickness by more than 10% are not acceptable and must be cut out and discarded.

C. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2. All pipe and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid.

D. Materials, if stored, shall be kept safe from damage and shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Pipe shall not be stored close to heat sources. The **Contractor** shall be responsible for all security, damage and loss of pipe.

E. The interior of the pipe as well as all sealing surfaces of mating components (i.e. flange faces) shall be kept free from dirt or foreign matter at all times. The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged to prevent insects, animals, or foreign material from entering the pipe line or pipe section. The practice of stuffing cloth or paper in the open ends of the pipe will not be permitted. Use waterproof nightcaps to prevent the entrance of any type of natural precipitation into the carrier or containment pipe and will be secured to the pipe in such a manner that the wind cannot blow them loose. Where possible, the pipe shall be raised and supported at a suitable distance from the open end such that the open end will be below the level of the pipe at the point of support.

3.08 RECEIPT INSPECTION

A. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are installed or lowered into the trench to be laid. Defective, damaged, or unsound pipe will be rejected. Cuts, punctures, or gouges that penetrate or reduce the wall thickness by 10% or more are not acceptable and must be removed and discarded. Joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the **Contractor**.

3.09 SLIP LINING INSTALLATION

A. Not Used

B. Pull-In Installation

1. Per ASTM F1804 and/or www.HDPEapp.com, the **Contractor** shall determine and document the maximum proposed pull-in length and pull-in force for the pressure class and pipe diameter to be pulled into an open trench. Pull-in lengths will not exceed the maximum lengths for the class and diameter pipe. A commercially available load limiter (weak link) approved by the Engineer shall be used between the puller and the pipe.

2. Prior to pulling the pipeline, **Contractor** shall place rollers or other approved devices beneath the pipe to avoid unnecessary damage and to reduce pipe drag.

3. Trenchless installations:
   a. For sliplining, refer to ASTM F585, PPI PE Handbook (Chapter 11) and www.HDPEapp.com

C. Appurtenances

1. All appurtenances (tees, elbows, services, valves, air relief valves, fire hydrants, etc.), must be independently supported and shall not rely on the pipeline and its connections for this support. Excessive stresses may be encountered when appurtenances are inadequately supported.

+++END OF SECTION 02624+++

SECTION 02641
PRECAST CONCRETE MANHOLES

PART 1 - GENERAL

1.01 SCOPE

A. This section includes precast concrete manholes installation; frames and covers; pipe connections at manholes; manhole testing; backfill; cleanup; and any other similar, incidental, or appurtenant operation that may be necessary to properly complete the Work.

B. The **Contractor** shall provide all services, labor, materials, and equipment required for all precast concrete manholes and related operations necessary or convenient to the **Contractor** for furnishing a complete Work as shown on the Plans or specified in these Specifications.

C. Related Sections Specified Elsewhere:

1. Section 01210 - Measurement and Payment
2. Section 02140 - Dewatering
3. Section 02200 - Earthwork
4. Section 02324 - Trenching and Trench Backfilling
5. Section 02510 - Pavement Repairs
6. Not Used
7. Not Used
8. Section 02920 - Site Restoration
9. Section 03300 - Cast-In-Place Concrete

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300. In addition, the following specific information shall be provided.

1. The **Contractor** shall submit manufacturer's data and details of the following items for approval:

a. Shop drawings of manhole sections and base units and construction details, including: reinforcement, jointing methods, and materials
b. Summary of criteria used in the manhole design including, as a minimum: material properties, loadings, load combinations, and dimensions assumed
c. Materials to be used in fabricating drop connections
d. Materials to be used for pipe connections at manhole walls
e. Materials to be used for stubs and stub plugs, if required
f. Materials and procedures for corrosion resistant liner and coatings, if required
g. Plugs to be used for vacuum testing

h. Manufacturer's data for pre-mix (bag) concrete, if used for channel inverts and benches
i. Description of the proposed method of concrete curing

1.03 QUALITY ASSURANCE

A. Reference Standards: The **Contractor** shall comply with the applicable provisions and recommendations of the latest editions of the following standards, except as otherwise shown on the Plans or specified in these Specifications.

1. ASTM C270 - Standard Specification for Mortar for Unit Masonry
2. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe using Rubber Gaskets
3. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections
4. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
5. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (non-shrink)

B. Prior to delivery, all basic materials specified in this section shall be tested and inspected by an approved independent commercial testing laboratory or, if approved by the **County**, certified copies of test reports prepared by the manufacturer's testing laboratory will be acceptable. All materials that fail to conform to these Specifications shall be rejected.

C. After delivery to the site of the Work, any materials that have been damaged in transit or are otherwise unsuitable for use in the Work shall be rejected and removed from the site of the Work.

D. Precast concrete producer shall demonstrate adherence to the standards set forth in the National Precast Concrete Association Quality Control Manual. Precast concrete producer shall meet requirements written below.

1. Qualifications, Testing and Inspection

a. The Precast concrete producer shall have been in the business of producing precast concrete products similar to those specified for a minimum of five (5) years. The precast concrete producer shall maintain a permanent quality control department or retain an independent testing agency on a continuing basis. The agency shall issue a report, certified by a licensed engineer, detailing the ability of the precast concrete producer to produce quality products consistent with industry standards.

b. The Precast concrete producer shall show that the following tests are performed in accordance with the ASTM standards indicated. Tests shall be performed for each one hundred fifty (150) cu. yd. of concrete placed, but not less frequently than once per week.

(1.) Slump: C143
(2.) Compressive Strength: C31, C192, and C39

(3.) Air Content (when air-entrained concrete is being used) C231 or C173
(4.) Unit Weight: C138

c. The Precast concrete producer shall provide documentation demonstrating compliance with this subparagraph.

d. The plant shall notify the **County** when the pre-cast products are being produced for the project. The **County** may place an inspector in the plant when the products covered by this specification are being manufactured.

1.04 DESIGN CRITERIA

A. Manholes shall be constructed of specified materials to the sizes, shapes, and dimensions and at the locations shown on the Plans or as otherwise directed by the **County**. The height or depth of the manhole will vary with the locations, but unless shown otherwise on the Plans shall be such that the top of the manhole frame will be at the finished grade of the pavement or higher than the ground surface as shown on the Plans and the invert shall be at the designed elevations.

PART 2 – PRODUCTS

2.01 PRECAST CONCRETE MANHOLES

A. Unless specified otherwise in the Plans or in the Special Conditions, all manholes shall be precast concrete manholes as specified in this section.

B. The precast reinforced concrete manholes shall be constructed in accordance with the requirements of ASTM C478. Reinforced concrete manholes shall consist of manhole base sections, riser sections, transition sections, and conical sections as described in this section. The manhole components shall be configured to minimize the number of joints required per manhole (see Detail Drawings). The **County** may require any manhole that is not composed of the minimum number of sections to be replaced.

C. Portland cement concrete used in the precast reinforced concrete manholes shall have a minimum compressive strength of four thousand (4,000) psi at twenty-eight (28) days.

1. The concrete shall contain type II Portland cement with a C3A content of five and one-half (5½) percent or less and meet the requirements of ASTM C478.

2. Aggregate for concrete, except for maximum size and gradation, shall be as specified in applicable sections of these Specifications.

3. To aid in achieving the specified concrete compressive strength, newly cast manholes shall be cured in accordance with the requirements of ASTM C478. The method of curing proposed shall be submitted to the **County** prior to manufacture. Manholes shall be cured for a minimum of

seven (7) days prior to shipment to the site unless otherwise instructed by the **County**.

4. The manhole manufacturer shall test the compressive strength of a minimum of two (2) concrete cylinders per calendar week. Reports verifying the results of the compression tests shall be maintained at the manufacturer's facility. Reports shall be made available for inspection and review by the **County's** representatives. The manhole manufacturer shall permit the **County**'s representatives to make unannounced reviews of compression test records and inspection of manufacturing facilities at any time during normal business hours.

5. The manhole manufacturer shall notify the **County** of all manholes delivered for use in the **County's** sanitary sewer system that were manufactured during a week for which a concrete compressive strength test yielded a result of less than four thousand (4,000) psi.

    a. Notification shall include (at a minimum) the project name, **Contractor** name, date of manhole component manufacture, and description of manhole component(s) affected.

    b. The **County** may require additional testing, repairs, or removal and replacement, at no additional cost to the **County**, of any or all manhole components provided for use in the **County's** sanitary sewer system that were manufactured during a calendar week for which a concrete compressive strength test yields a result of less than four thousand (4,000) psi.

D. Reinforcing steel shall be bars of intermediate grade, open hearth, billet steel, conforming to the requirements of ASTM A615, or Cold-Drawn Steel Wire for Concrete Reinforcement conforming to the requirements of ASTM A82; or of wire fabric conforming to the requirements of ASTM A185. The circumferential reinforcement in the riser and conical top sections shall have an area of not less than twelve-hundredths (0.12) square inches per linear foot.

E. The interior and exterior surfaces of the manhole shall have a smooth hard finish, and shall be free from cracks, chips, and spalls.

F. The maximum allowable absorption of the concrete used for manhole construction shall not exceed eight (8) percent of the dry weight.

G. Manhole base sections shall be circular, wet cast, and may be supplied in forty-eight (48) inches, sixty (60) inches, seventy-two (72) inches, eighty-four (84) inches, and ninety six (96) inches diameters. Heights shall range from forty-eight (48) inches to ninety six (96) inches depending on availability with diameter and as specified or approved by the **County**. All base sections shall be supplied with Manhole Lift System inserts as manufactured by Press-Seal Gasket Corporation. Lifting eye bolts, also manufactured by Press-Seal Gasket Corporation, shall be supplied to the **Contractor** upon request. Manhole bases manufactured with pipe openings eighteen (18) inches or less shall be furnished with Kor-N-Seal flexible pipe-to-manhole connectors. Pipes with diameters greater than eighteen (18)

inches shall be secured with a concrete cradle installed to the springline of the pipe utilizing Class “B” concrete conforming to the requirements of Section 03300 - Cast-In-Place Concrete.

H. Riser sections shall be circular, wet, or dry cast, and may be supplied in the following sizes: forty-eight (48) inches, sixty (60) inches, seventy-two (72) inches, eighty-four (84) inches, and ninety-six (96) inches in diameter. Heights shall range from sixteen (16) inches to forty-eight (48) inches in sixteen (16) inch multiples depending on availability with diameter and as specified or approved by the **County**. All riser sections shall be supplied with Manhole Lift System inserts as manufactured by Press-Seal Gasket Corporation. Lifting eye bolts, also manufacture by Press-Seal Gasket Corporation, shall be supplied to the **Contractor** upon request.

I. Transition sections shall be wet or dry cast. Conical transition sections shall be supplied for sixty (60) inch to forty-eight (48) inch diameter transitions. Conical transitions shall be thirty-two (32) inches high. Sixteen (16) inches high conical transitions may be used only when approved by the **County**. All conical transition sections shall be supplied with a Manhole Lift System as manufactured by Press-Seal Gasket Corporation. Flat slab transitions shall be supplied for base sections seventy-two (72) inches to ninety six (96) inches in diameter. Flat slab transitions shall be manufactured structurally to meet individual project requirements. Clear access openings shall be provided to accommodate riser sections as shown in the Plans or as detailed in the Detail Drawings.

J. Conical sections shall be wet or dry cast, eccentric only. Concentric sections shall not be allowed. Conical sections shall transition from forty-eight (48) inches in diameter to a twenty-four (24) inch clear access opening and be thirty-six (36) inches high. They shall be supplied with a Manhole Lift System as manufactured by Press-Seal Gasket Corporation

K. Precast manhole riser joints shall be offset tongue and groove type, supplied with Tylox Super Seal pre-lubricated gasket as manufactured by Hamilton Kent. Each joint shall also be supplied with Conseal CS-231 waterstop sealant as manufactured by Concrete Sealants, in widths as recommended by the manufacturer.

L. The ends of each reinforced concrete manhole riser section and the bottom end of the manhole top section shall be so formed that when the manhole risers and the top are assembled, they will make a continuous uniform manhole.

M. Standard manholes of precast concrete construction, and other manholes of precast concrete construction having entering sewers of twenty-four (24) inches in diameter or smaller shall have precast openings in the manhole walls for incoming or outgoing sewers as indicated on the Plans.

N. All components of a manhole for a particular location shall be clearly marked in order that the manhole may be correctly assembled to suit construction conditions existing at that particular location.

O. All precast concrete manhole base sections and drop manhole bases shall be set on a foundation of #57 compacted stone aggregate, twelve (12) inch minimum thickness, and covering the entire bottom of the excavation for the manhole. Aggregate size may be adjusted by the **County** based on field conditions.

P. Manhole steps shall conform to the requirements of this section.

2.02 STRUCTURAL MATERIALS AND CASTINGS

A. Structural steel shall conform to the requirements of ASTM A283, unless otherwise indicated on the Plans.

B. Steel castings shall conform to the requirements of ASTM A27. The grades to be used shall be specified in the Special Conditions or indicated on the Approved Plans.

C. Gray iron castings shall conform to the requirements of ASTM A48. All castings shall be clean and free of scale, adhesions, or inclusions. Gray iron castings for manhole or inlet frames and covers or gratings shall be cast from Class 30B cast iron. Bearing surfaces between manholes, inlet frames, and covers or gratings shall be such that the cover or grating shall seat in any position onto the frame without rocking. Bearing surfaces for standard manhole frames and covers shall be machined.

D. Aluminum castings shall conform to the requirements of ASTM B108.

E. Structural aluminum shall conform to the requirements of ASTM B209, B221, B308, B241, or B211, as applicable. Finished bolts and nuts shall be given an anodic coating of at least 0.0002 inches in thickness.

2.03 FRAMES, COVERS, AND STEPS

A. New manhole rims, toe pockets, frames, and covers shall be cast iron conforming to the requirements of ASTM A48 for Class 30 Gray Iron Castings. All castings shall be made accurately to the required dimensions, fully interchangeable, sound, smooth, clean, and free from blisters or other defects. Defective castings that have been plugged or otherwise treated shall not be used. All castings shall be thoroughly cleaned and painted or coated with bituminous paint. Each casting shall have its actual weight in pounds stenciled or painted on it in white paint.

B. Manhole frames and covers shall be as detailed on the Plans, and as manufactured by Vulcan Foundry, or as manufactured by the Griffin Foundry Co., Russell Pipe and Foundry Co., or approved equal. Manhole covers shall be vented except those located within the one hundred (100) year flood plain, within three (3) feet of curb for a two (2) lane road, or within the outside lane of a multi-lane road.

C. Sanitary sewer manhole covers shall have the words cast on the top in letters two (2) inches high per the **County** Standard Detail.

D. Manhole inlet steps shall be made of steel reinforced copolymer polypropylene model PS-1 PF. They shall be installed at maximum sixteen (16) inch intervals. Manhole steps shall be as shown in the Detail Drawings with rod and pull ratings meeting OSHA standards.

2.04 SPECIALTY ITEMS

A. One-piece manholes shall be manufactured in accordance with the requirements of ASTM C478 and as detailed in the Detail Drawings. They shall be cast utilizing four thousand (4,000) psi concrete containing type II cement with a C3A content of five and one-half (5½) percent or less. They shall be manufactured within a minimum eight (8) inches thick base with dowel steel reinforcement and waterstop. They shall be used only in situations that will not accommodate a twenty-four (24) inch base section and twenty-four (24) inch conical section.

B. Manhole Tees measuring thirty-six by forty-eight (36 x 48) inches shall be manufactured in accordance with the requirements of ASTM C478 and as detailed in the Detail Drawings. They shall be cast utilizing 4000 psi concrete containing type II cement with a C3A content of five and one-half (5½) percent or less.

C. Saddle manholes shall be manufactured in accordance with the requirements of ASTM C478 and as shown in the Detail Drawings. They shall be cast utilizing four thousand (4,000) psi concrete containing type II cement with a C3A content of five and one-half (5½) percent or less.

D. Drop Manholes (Memphis Tees) shall be manufactured in accordance with the requirements of ASTM C478 and as detailed in the Detail Drawings. They shall be cast utilizing four thousand (4,000) psi concrete containing type II cement with a C3A content of five and one-half (5½) percent or less.

2.05 NOT USED

2.06 CONCRETE

A. Concrete shall conform to requirements of Section 03300 - Cast-In-Place Concrete.

2.07 NOT USED

PART 3 - EXECUTION

3.01 GENERAL

A. All activities shall be performed in accordance with the manufacturer's recommendations and regulations established by OSHA. Particular attention shall be drawn to those safety requirements involving working with scaffolding and entering confined spaces.

B. The **Contractor** shall verify that lines and grades are as specified in the Plans.

3.02 INSTALLATION

A. Manholes shall be constructed to the sizes, shapes, and dimensions as detailed in the Detail Drawings and at the locations shown on the Plans. They shall be constructed of precast concrete sections conforming to the requirements of this section. The manholes shall be assembled with the fewest number of sections to make up required height, thereby reducing the number of joints. The composition of the manhole shall be approved by the **County**. The **County** may require any manhole that is not composed of the minimum number of sections to be replaced. The depth of the manhole will vary with the location but in all cases, it shall be such as will place the cover (or lid) at the finished grade of the pavement or ground surface or as otherwise indicate on the Plans. In undeveloped or rural areas, manholes shall be furnished to a height of two (2) feet above ground. Concentric cone sections and flat top manholes, except for shallow depth where approved by the **County**, shall not be allowed; only eccentric cones shall be used.

B. Precast concrete manholes for reinforced concrete sewers forty-eight (48) inches in diameter and larger shall be as specified above, except that they shall be installed on a saddle constructed on the barrel of the sewer. Precast concrete manholes for sewers of thirty (30), thirty-six (36), and forty-two (42) inches shall be saddle-types or precast base types as specified in the Plans. Reinforcing steel in the saddle shall be welded to the reinforcing steel of the pipe. The design of these saddles shall be approved by the **County** prior to manufacture.

C. All joints for precast manhole stacks shall be offset tongue and groove with Tylox Super Seal pre-lubricated gaskets as manufactured by Hamilton Kent. Each joint shall also be sealed with Conseal CS-231 waterstop sealant as manufactured by Concrete Sealants. The width and installation of the joint sealant shall be in accordance with the manufacturer's recommendations. All joints shall be supplied with three inches by sixteen inches by one-half inch (3" x 16" x ½") bitumastic coated steel strap anchors. Three (3) strap anchors, one-hundred, twenty (120) degrees apart, shall be required per joint.

D. Where the difference in the invert elevation of two (2) or more sewers, eighteen (18) inches in diameter or smaller, intersecting in one (1) manhole is two (2) feet or more, a Drop Manhole shall be constructed in the manner shown in the Detail Drawings. They shall be similar in construction to the standard manhole, except that a drop connection of a pipe and fittings of the proper size and material shall be constructed with an outside or inside drop in the manhole as directed by the **County** and if required supported by Class B concrete as indicated on the Plans and in the Detail Drawings. The manhole and the drop connection shall be placed on twelve (12) inch reinforced concrete base as detailed in the Detail Drawings. The drop connection piping assembly shall be bolted to the barrel of the manhole riser using a minimum diameter of four (4) five-eighths (5/8) inches Type 316 stainless steel bolts with suitable washers to prevent failure caused by pulling the bolt head through the manhole wall.

E. Base sections shall be precast with the vertical walls of sufficient height to allow entry of the required pipes as shown on the Plans, and as detailed in the Detail Drawings. Manhole inverts shall be constructed of cement mortar and shall have the same cross-section as the invert of the sewers that they connect. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit.

F. All water standing in the trench shall be removed before placing of concrete is started, and the foundation maintained in a dry condition.

G. Shallow manholes shall be constructed to the sizes, shapes, and dimensions as detailed in the Detail Drawings, and at the locations shown on the Plans. They shall be constructed of precast concrete sections as shown on the Plan and as directed by the **County**.

H. The top elevation of manhole frames shall be adjusted to grade in areas such as streets, alleys, and parking lots or where indicated on the Plans. A maximum adjustment of twelve (12) inches shall be allowed using brick and mortar. Adjustments greater than twelve (12) inches shall be made by changing precast riser sections or as directed by the **County**. Brick used shall be in accordance with the requirements of this Section.

3.03 PIPE CONNECTIONS AT MANHOLES

A. Openings in manhole walls for incoming and outgoing sewers shall be precast or cored and after installation sealed with an approved non-shrink grout only if an approved flexible manhole connector cannot be used. The method shall be compatible with the incoming and outgoing sewer pipe material to seal leakage. These manholes shall be installed on chocked and compacted stone bedding as shown in the Detail Drawings.

B. A flexible manhole connector shall be the method of sealing the space between the manhole wall and the pipe. Flexible manhole sleeves shall be required for all pipes eighteen (18) inches and smaller. The manhole connector shall be Kor-N-Seal or equal and conform to the requirements of ASTM C923 and shall be made from ethylene propylene rubber (EPDM) designed to be resistant to ozone, weather elements, chemicals, including acids, alkalis, animal and vegetable fats, oils, and petroleum products. Manhole sleeves shall be secured to pipe by stainless steel clamp and bolt assembly conforming to the requirements of ASTM C923 and ASTM A167.

C. All stainless steel elements of the manhole connector shall be totally non-magnetic Type 304 Stainless, excluding the worm screw for tightening the steel band around the pipe that shall be Type 305 Stainless. The worm screw for tightening the steel band shall be torqued by a break-away torque wrench available from the precast manhole supplier, and set for sixty to seventy (60 to 70) inch/pounds. The connector shall be installed in the manhole wall by activating the expanding mechanism in strict accordance with the

recommendation of the connector manufacturer. The connector shall be of a size specifically designed for the pipe material and size being utilized on the Project.

3.04 MANHOLE TESTING

A. All manholes shall be vacuum tested in accordance with the requirements of Section 02650 - Testing for Acceptance of Sanitary Sewers.

3.05 BACKFILL

A. The **Contractor** shall place and compact backfill materials in the area of excavation surrounding manholes in accordance with the requirements of Section 02200 - Earthwork.

3.06 CLEANUP

A. After the manhole installation Work has been completed and all testing accepted by the **County**, the **Contractor** shall clean up the area. All excess material and debris not incorporated into the permanent installation shall be disposed of by the **Contractor** in a lawful manner. Disturbed grassed areas shall be seeded or sodded. Site restoration shall be performed in accordance with the requirements of Section 02920 - Site Restoration.

+++END OF SECTION 02641+++

SECTION 02650
PIPING TESTING AND ACCEPTANCE

PART 1 GENERAL

1.01 SCOPE

A. Furnish all labor, materials, tools, equipment and related items required to perform tests of gravity pipelines and perform integrity and leakage tests of pressure and vacuum piping.

B. The testing requirements covered under this Section and the DeKalb County Department of Watershed Management Design Standards Manual shall apply to all piping systems covered under Section 02537 and 02624 of these Specifications.

1.02 SUBMITTALS

Submittals shall conform to the requirements of Section 01340 of these Specifications and shall include a description of the testing procedures to be employed and the report form to be furnished.

PART 2 PRODUCTS

2.01 TEST MEDIUMS

The Owner will provide the necessary water required for testing the work. The **Contractor** shall furnish all other test mediums. The **Contractor** shall furnish all equipment, necessary piping and required labor to transport water from its source to the test location for use in testing.

2.02 TEST EQUIPMENT

The **Contractor** shall furnish all labor and equipment, including required pumps with regulated bypass meters and gauges, for conducting of the piping tests.

PART 3 EXECUTION

3.01 GENERAL

A. The entire length of all pressurized piping and gravity lines shall be field tested for tightness by a test as described in this Section.

B. The timing and sequence of testing shall be scheduled by the **Contractor**, subject to the approval of the Engineer. The **Contractor** shall provide the Engineer with a minimum of 24 hours' notice prior to the start of any test. All tests must be observed by the Engineer.

C. The **Contractor** shall repair any leaks discovered during the initial filling of the piping and during the testing sequence. All known and visible leaks shall be repaired, whether or not the leakage rate is within allowable limits.

3.02 MAJOR PIPING

A. Storm drains shall be exempted from testing required by this Section.

B. Clean and test lines before requesting final acceptance. Where any obstruction is met, clean the lines by means of rods, swabs, or other instruments. When requested by the Engineer, flush out lines and manholes before final inspection.

C. Gravity Piping

1. Pipe lines shall be straight and show a uniform grade between manholes. Correct any discrepancies discovered during inspection.

2. Pipe joints for sewers 30-inches in diameter and larger shall be air tested individually. The joint tester assembly shall be placed over the joint and shall pressurize the joint area to 4 psi. The pressure shall not drop more than 2 psi in 10 seconds. The joint tester assembly shall be equal to Cherne Industries, Inc.

3. Infiltration Tests: Use only when groundwater is two feet above the top of the pipe.

   a. Install suitable weirs in manholes selected by the Engineer to determine the leakage of ground water into the sewer. Measure leakage only when all visible leaks have been repaired and the ground water is two feet above the top of the pipe. If leakage in any section of the pipeline exceeds 25 gpd/inch/diameter/mile, locate and repair leaks. Repair methods must be approved by the Engineer. After repairs are completed, re-test for leakage.

   b. Furnish, install and remove the necessary weirs, plugs and bulkheads required to perform the leakage tests. Where continuous monitoring of flow level is required, the **Contractor** shall provide and operate monitoring equipment.

4. Exfiltration Tests: Use the following when groundwater is not two feet above the top of the pipe.

   a. Hydrostatic Test

      i. Test pipe between manholes or structures with a minimum of 10 feet hydrostatic pressure, measured at the center of the pipe at the upstream manhole or structure.

ii. The ends of the pipe in the test section shall be closed with suitable watertight bulkheads. Inserted into the top of each bulkhead shall be a 2-inch pipe nipple with an elbow. At the upper end of the test section, a 12-inch riser pipe shall be connected to the 2-inch nipple. The test section of pipe shall be filled through the pipe connection in the lower bulkhead which shall be fitted with a valve, until all air is exhausted and until water overflows the riser pipe at the upper end. Water may be introduced into the pipe 24 hours prior to the test period to allow complete saturation. House service lines, if installed, shall also be fitted with suitable bulkheads having provisions for the release of air while the test section is being filled with water.

iii. During the test period, which shall extend over a period of 2 hours, water shall be introduced into the riser pipe from measured containers at such intervals as are necessary to maintain the water level at the top of the riser pipe. The total volume of water added during the test period shall not exceed that specified for infiltration.

D. Pressure Piping

1. All sections of pipeline subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of line will be considered ready for testing after completion of all thrust restraint and backfilling.

2. Each segment of pipeline between line valves shall be tested individually.

3. Test Preparation

a. For pipelines less than 24-inches in diameter, flush pipeline section thoroughly at flow velocities greater than 2.5 feet per second, adequate to remove debris from pipe and valve seats. For pipelines 24-inches in diameter and larger, the main shall be carefully swept clean and mopped, if directed by the Engineer. Partially operate valves and hydrants to clean out seats. Provide correctly sized temporary outlets in number adequate to achieve flushing velocities.

b. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.

c. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Unless permanent air vents are in place, insert temporary corporation stops at highpoints to expel air as line is filled with water.

d. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure.

Differential pressure at valves and hydrants shall equal the maximum possible, but shall not exceed manufacturer's pressure rating. Where necessary, provide temporary back pressure to meet the differential pressure restrictions.

e. Valves and hydrants shall not be operated in either the opening or closing direction at differential pressures above their rated pressure.

4. The test pressure shall be measured at the lowest point in the test segment and shall be maintained for a minimum of two hours. Test piping in accordance with the minimum test pressures shown below:

Pipe Designation	Pipe Size, inches	Test Pressure, psi
FM	8	200
FM	16, 24	200
PW	1 ½, 2, 2 ½, 4, 6	150
NPW	2, 2 ½	150

5. The test pressure shall not vary by more than 5 psi for the test duration. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. Provide an accurate pressure gage with graduation not less than 5 psi.

6. Leakage: Leakage shall be defined as the quantity of water that must be pumped into the test section equal to the sum of the water, to maintain pressure within 5 psi of the specified test pressure for the test duration plus water required to return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter.

7. Test Results: No test section shall be accepted if the leakage exceeds the limits determined under Section 4 of AWWA C600. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.

8. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.

3.03 MANHOLES

A. Prior to testing manholes for watertightness, all liftholes shall be plugged with a non-shrink grout, all joints between precast sections shall be properly sealed and all pipe openings shall be temporarily plugged and properly braced. Each manhole shall pass one of the following tests:

1. Exfiltration Tests: The manhole, after proper preparation as noted above, shall be filled with water. The maximum allowable leakage shall be 0.1

gallon per hour per foot of diameter per foot of depth. Tests shall last a minimum of eight hours. The manholes may be backfilled prior to testing.

2. Vacuum Tests: The manhole, after proper preparation as noted above, shall be vacuum tested prior to backfilling. The test head shall be placed at the inside of the top of the cone section and the compression head inflated to 40 psi to affect a seal between the vacuum base and the manhole structure. Connect the vacuum pump to the outlet port with the valve open. A vacuum of 10-inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9-inches. The manhole shall pass if the time is greater than 60 seconds for 48-inch diameter manholes. If the manhole fails the initial test, necessary repairs shall be made with non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained. Vacuum testing equipment shall be equal to that as manufactured by P.A. Glazier, Inc.

3.04 REPAIRS

If the leakage exceeds the specified allowable limits, the point or points of leakage shall be sought out and remedied by the **Contractor** at no additional cost to the **County**. Repair methods must be approved by the Engineer.

3.05 FLUSHING AND CLEANING

The systems shall not be used, except for chemical cleaning, until the Engineer has been assured that cleaning has been accomplished.

3.06 FINAL ACCEPTANCE

A. No pipeline installation shall be accepted until all known and visible leaks have been repaired, whether or not the leakage is within the maximum allowable limits.

B. The **Contractor** will certify that all required tests have been successfully completed before the work is accepted.

END OF SECTION

SECTION 02665

WATER MAINS AND ACCESSORIES

PART 1 - GENERAL

1.01 SCOPE

A. The work included under this section includes providing all labor, materials, equipment, tools, and incidentals required for a complete installation of water mains and accessories as shown on the Plans and as specified in this section.

B. The **Contractor** shall supply all products and perform all work in accordance with applicable American Society for Testing and Material International (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), Steel Structures Painting Council (SSPC), and other recognized standards. Latest revisions of all standards are applicable.

C. Galvanized pipe/fittings shall not be used as any part of the Water Transmission and Distribution System, nor shall it be used to join any appurtenances to the System.

D. Water mains, valves, hydrants, and appurtenances shall be installed before the installation of the sub-base course or paving or any other utilities except sanitary sewer lines.

E. All water system products and materials shall be submitted for approval by the **County**. Each shall meet all design and operating requirements of the **County**.

F. Related Work Specified Elsewhere:

1. Section 01210 - Measurement and Payment
2. Section 01550 - Traffic Regulation
3. Section 02000 – Site Work
4. Section 02140 - Dewatering
5. Section 02200 - Earthwork
6. Section 02324 - Trenching and Trench Backfilling
7. Section 02510 - Pavement Repairs
8. Section 02521 - Concrete Sidewalks, Curbs, and Gutters

9. Section 02920 - Site Restoration

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and **Section 01300 – Submittals**. In addition, the following specific information shall be provided:

1. Complete product data and engineering data, including shop drawings.

2. Documentation that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two (2) years.

3. Written certification to the **County** that all products furnished comply with all applicable requirements of these Specifications.

1.03 QUALITY ASSURANCE

A. Reference Standards: The **Contractor** shall comply with the applicable provisions and recommendations of the latest editions of the following standards, except as otherwise shown on the Plans or specified in these Specifications.

1. ANSI A21.4 (AWWA C104) - Cement Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings, for Water and Other Liquids.

2. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

3. ANSI B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

4. ANSI B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.

5. ASTM B32 - Standard Specification for Solder Metal.

6. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

7. ASTM C150 - Standard Specification for Portland Cement.

8. ASTM D1248 - Polyethylene Plastics Molding and Extrusion Materials.

9. ASTM G62 - Test Methods for Holiday Detection in Pipeline Coatings.

10. AWWA C104 (ANSI A21.4) - Cement Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings, for Water and Other Liquids.

11. AWWA C110 (ANSI A21.10) - Ductile Iron and Gray Iron Fittings, 3-in. through 48-in., for Water and Other Liquids.

12. AWWA C111 (ANSI A21.11) - Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.

13. AWWA C115 (ANSI A21.15) - Flanged Ductile Iron Pipe with Threaded Flanges.

14. AWWA C150 (ANSI A21.50) - Thickness Design of Ductile Iron Pipe.

15. AWWA C151 (ANSI A21.51) - Ductile Iron Pipe, Centrifugally Cast for Water and Other Liquids.

16. AWWA C153 (ANSI A21.53) - Ductile Iron Compact Fittings, 3-in. through 24-in. and 54-in. through 64-in., for Water Service.

17. AWWA C600 - Installation of Ductile Iron Water Mains and Their Appurtenances.

18. AWWA C606 - Joints, Grooved and Shouldered Type.

19. AWWA C651 - Disinfecting Water Mains.

20. SSPC-SP6 - Steel Structures Painting Council, Commercial Blast Cleaning.

21. Other ANSI, ASTM, and AWWA specifications referenced herein.

1.04 TRANSPORTATION AND HANDLING

A. Unloading: The **Contractor** shall furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves, and accessories. The **Contractor** shall make equipment available at all times for use in unloading. The **Contractor** shall not drop or dump materials. All materials dropped or dumped shall be subject to rejection without additional justification. Pipe handled on skids shall not be rolled or skidded against the pipe on the ground.

B. Handling: The **Contractor** shall handle pipe, fittings, valves, and accessories carefully to prevent shock or damage. The **Contractor** shall handle pipe by rolling on skids, forklift, or front-end loader. The **Contractor** shall not use material damaged in handling. Slings, hooks, or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior coatings or internal lining of the pipe.

1.05 STORAGE AND PROTECTION

A. The **Contractor** shall store all pipes that cannot be distributed along the route. The **Contractor** shall make arrangements for the use of suitable storage areas.

B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that shall protect them from damage by freezing.

C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails, or concrete. Pipe in tiers shall be alternated: bell-plain end; plain end-bell. At least two (2) rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipes in adjacent tiers.

D. Stored mechanical and push on joint gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first in, first out basis.

E. Mechanical-joint bolts shall be handled and stored in such a manner that shall ensure proper use with respect to types and sizes.

1.06 WATER MAIN LOCATION

A. Except as otherwise shown on the Plans, the minimum depth of cover shall be four (4) feet and the maximum cover shall be five (5) feet. All deviations shall be specifically approved by the **County**.

B. The installation of a water main parallel to another utility in the same vertical plane is not permitted, i.e., “stacking” of utilities is not permitted.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE

A. Ductile iron pipe shall be manufactured in accordance with the requirements of AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of eighteen (18) to twenty (20) feet. Sizes shall be as shown on the Plans. All pipe shall have a minimum pressure rating as indicated in following Table below, and corresponding minimum wall thickness, unless otherwise shown on the Plans, specified in these Specifications, or approved by the **County**.

Pipe Diameter (inches)	Pressure Class (psi)
4 – 12	350

14 – 18	350
20	300
24	250
30 – 54	200
60 – 64	200

B. Flanged pipe minimum wall thickness shall be equal to Special Class 53. Flanges shall be furnished by the pipe manufacturer.

C. Ductile Iron Pipe and fittings shall be cement lined in accordance with the requirements of AWWA C104. A seal coat over the cement lining is not required. Pipe and fittings shall be furnished with a bituminous outside coating.

D. Fittings shall be ductile iron and shall conform to the requirements of AWWA C110 or AWWA C153 with a minimum rated working pressure of two-hundred and fifty (250) psi.

E. Malleable iron threaded fittings and appurtenances shall conform to the requirements of ASTM A47, ASTM A197, or ANSI B16.3

F. Unless otherwise specified, steel fittings and appurtenances shall conform to the requirements of ASTM A234, ASTM A105, or ANSI B16.11; and fabricated steel fittings and appurtenances shall conform to the requirements of AWWA C208.

G. Fittings for grooved end piping systems shall be full flow cast fittings, steel fittings, or segmentally welded fittings with grooves or shoulders designed to accept grooved end couplings. Cast fittings shall be cast of ductile iron conforming to the requirements of ASTM A536 or malleable iron conforming to the requirements of ASTM A47. Standard steel fittings, including large size elbows, shall be forged steel conforming to the requirements of ASTM A106. Standard segmentally welded fittings shall be fabricated of Schedule 40 carbon steel pipe.

H. Joints:

1. Unless shown or specified otherwise, joints for ductile iron pipe shall be push on or restrained joint type for pipe and standard mechanical, push on, or restrained joints for fittings. Push on and mechanical joints shall conform to the requirements of AWWA C111.

2. The only acceptable restrained joint systems for ductile iron pipe are identified in the Table below, unless approved by the **County**. No field welding of restrained joint pipe shall be allowed.

Acceptable Restrained Joints				
Diameter (inches)	**ACIPCO**	**U.S. Pipe**	**McWayne**	**Generic[(1)]**
4 – 12	Fast-Grip Flex Ring	Field Lok TR Flex	Push-On Restrained Joint Type A	MJ with Retainer Gland
16 – 24	Fast-Grip Flex Ring	Field Lok TR Flex	Push-On Restrained Joint Type A	MJ with Retainer Gland
30 – 36	Flex Ring	TR Flex	Push-On Restrained Joint Type B	MJ with Retainer Gland
42 – 48	Lok-Ring	TR Flex	N/A	MJ with Retainer Gland
54 – 64	Lok-Ring	TR Flex	N/A	N/A

(1) Fittings and valves only, and only where specifically allowed.

3. Restrained joint pipe (RJP) on supports shall have bolted joints and shall be specifically designed for clear spans of at least thirty-six (36) feet and as approved be the **County**

4. Flanged joints shall meet the requirements of ANSI B16. 1, Class 125.

I. The **Contractor** shall provide the appropriate gaskets for mechanical and flange joints. Gaskets for flange joints shall be made of one-eighth (⅛) inch thick, cloth reinforced rubber; gaskets may be ring type or full-face type.

J. Bolts and Nuts:

1. The **Contractor** shall provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with the requirements of ANSI B1.1, Coarse Thread Series, Class 2A external, and 2B internal fit. All bolts and nuts shall be made in the U.S.A.

2. Bolts and nuts for mechanical joints shall be Tee Head Bolts and nuts of high strength low alloy steel in accordance with the requirements of ASTM A242 to the dimensions shown in AWWA C111/ANSI A21.11.

3. Flanged joints shall be bolted with through stud or tap bolts of required size as directed. Bolt length and diameter shall conform to the requirements of ANSI/AWWA C115 for Class 125 flanges shown in ANSI/ASME B16.1.

4. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to the requirements of ASTM A307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to the requirements of ASTM B633, Type II.

5. Bolts for submerged service shall be stainless steel machine bolts conforming to the requirements of ASTM A193, Grade B8. Nuts shall be heavy hex, stainless steel conforming to the requirements of ASTM A194, Grade 8.

K. Mechanical joint glands shall be ductile iron.

L. Welded Outlet: Welded outlets may be provided in lieu of tees or saddles on mains with a diameter greater than or equal to twenty four (24) inches. The pipe joint on the outlet pipe shall meet the joint requirements specified above. All welding shall be performed by a certified welder and approved by the **County**. The minimum pipe wall thickness of the parent pipe and the outlet pipe shall be Special Thickness Class 53 [Pressure Class 350 for sixty (60) and sixty-four (64) inch sizes]. The welded outlet shall be rated for two hundred and fifty (250) psi working pressure. Each welded outlet shall be hydrostatically tested at five hundred (500) psi or as approved by the **County**. The welded outlet shall be fabricated by the manufacturer of the parent pipe. The maximum outlet diameters shall not exceed those listed in the following table:

Parent Pipe Diameter (inches)	**Maximum Outlet Diameter (inches)**
24	16
30	20
36	24
42	30
48	30
54	30
60	30
64	30

M. Ductile iron pipe shall be encased with polyethylene film where shown on the Plans. Polyethylene film shall be in accordance with the requirements of AWWA C105.

N. Acceptance shall be based on the **County**'s inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

2.02 PIPE LINING

A. Cement Mortar: Unless otherwise specified, pipe and fittings shall be lined with cement mortar as specified in AWWA C205. Fittings and specials larger than twenty four (24) inches not fabricated from centrifugally lined straight sections shall require two (2) inches by four (4) inches by thirteen (13) gage self-furring wire mesh reinforcement for hand-applied lining.

2.03 PIPE COATING

A. Epoxy: Unless otherwise specified, pipe and fittings shall be coated with a liquid epoxy as specified in AWWA C210 with the following requirements:

1. No Coal tar products shall be incorporated in the liquid epoxy.

2. The curing agent may be an amidoamine as well as other curing agents listed in AWWA C210

3. The coating shall be applied to a minimum thickness of sixteen (16) mils in not less than two (2) coats.

B. Polyethylene tape: Where shown on the Plans or directed by the **County**, pipe and fittings shall be coated and wrapped with prefabricated multi-layer cold applied polyethylene tape coating in accordance with the requirements of AWWA C214. The coating application shall be a continuous step operation in conformity with the requirements of AWWA C214, Section 3. The total coating thickness shall be not less than fifty (50) mils for pipe twenty four (24) inches and smaller and not less than eighty (80) mils for pipe twenty six (26) inches and larger.

2.04 FUSION EPOXY COATING AND LINING

A. Where shown on the Plans or directed by the **County**, steel pipe and fittings shall be fusion epoxy coated and lined. The fusion epoxy coating shall be 3M Scotchkote 203, or approved equal, approved by the **County**. Surface preparation shall be in accordance with the requirements of SSPC-SP 10 near white blast cleaning. The application method shall be by the fluidized bed method and shall attain twelve (12) mils minimum dry film thickness.

B. Field welds, connections, and otherwise damaged areas shall be coated and patched according to the manufacturer's instructions with 3M Scotchkote 306 or approved equal

2.05 COPPER PIPE

A. Pipe shall be rolled copper tubing, ASTM B 88, Type K.

B. Where required, sweat to screw adapters shall be cast bronze ANSI B16.18, wrought solder joint ANSI B16.22. Unions shall be cast bronze or bronze with solder connections. Joints shall be made with 95/5 solder for Type K pipe. All fittings less than or equal to 1" shall be flared unless otherwise approved by the **County**.

2.06 PIPING APPURTENANCES

A. Retainer Glands:

1. Retainer glands shall be Megalug Series 1100, as manufactured by EBAA Iron, Uni-Flange Series 1400 or equal, as manufactured by Ford Meter Box Company.

2. Retainer glands shall be provided at all mechanical joints, including fittings, valves, hydrants and other locations as shown on the Plans.

B. Hydrant Tees: Hydrant tees shall be ACIPCO A10180 or U.S. Pipe U 592 or approved equal.

C. Anchor Couplings: Lengths and sizes shall be as shown on the Plans. Anchor couplings shall be equal to ACIPCO A 10895 or U.S. Pipe U 591.

D. Hydrant Connector Pipe: The connector pipe shall be ductile iron meeting the requirements of AWWA C153; twenty-four (24) inch offset design so that the hydrant can be adjusted to ensure placement at the proper grade; shall have an anchoring feature at both ends so that when used with M.J. split glands a restrained joint is provided; cement lined in accordance with AWWA C104 and equal to the Gradelok as manufactured by Assured Flow Sales, Inc., Sarasota, Florida.

E. Tapping Saddles: Tapping saddles are not allowed unless approved by the **County**

F. Detection Tape: Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Water Systems, Safety Precaution Blue, and "Caution Water Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be a minimum of two (2) inches when buried less than ten (10) inches below the surface. Tape width shall be a minimum of three (3) inches when buried greater than ten (10) inches and less than twenty (20) inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

2.07 FIRE HYDRANTS

A. General: Fire hydrant shall be a two (2) piece standpipe and stem, compression shutoff, dry-barrel type. Fire hydrant shall conform to the requirements of AWWA C502 and shall be listed by Underwriters Laboratories, Inc. in accordance with the requirements of UL 246.

B. Acceptable Products: Fire hydrants shall be American Valve and Hydrant B-62-B, M & H 129T, Mueller Super Centurion 250-AWB, A-423, Kennedy K81A, U.S. Metropolitan 250, or approved equal.

C. Product Data: The following information shall be provided to the **County**:

1. Affidavit of compliance with the requirements of AWWA C502.

2. Records of standard tests.

D. Manufacture

1. Fire hydrant shall be cast iron traffic, three (3) way four and one-half-(4½) inch valve, and left opening type.

2. Internal main valve diameter shall be a minimum of five and one quarter (5¼) inches.

3. Each hydrant shall have the name of the manufacturer, the year of manufacture, and the nominal size in legible, raised letters cast on the barrel or bonnet.

4. Each hydrant shall be constructed with a moist-proof lubricant chamber that encloses the operating threads and which provides automatic lubrication of the threads and bearing surfaces each time the hydrant is operated. The bonnet shall have “O” ring packing and reservoir capable of utilizing oil or grease so that all operating parts are enclosed in the lubricant.

5. Operating nut shall be bronze, seven eights (7/8) inch tapered square nut with tamper-proof device. The direction “opening left” shall be marked on a special tamper-proof device. The tamper-proof device shall be a combination fold-down nut for the op-nut. Hydrant shall have ductile iron combination hold-down nut and operating nut shield to eliminate operation of hydrant with wrenches other than a special socket-type wrench. Arrow shall be cast on the outside of the periphery of the operating nut shield indicating direction of the operation for opening the hydrant.

6. The hydrant barrel section shall be connected at the ground line in a manner that shall prevent damage to the hydrant when struck by a vehicle. The main valve rod section shall be connected at the ground line by a frangible coupling. The standpipe and ground line safety construction shall

be such that the hydrant nozzles can be rotated to any desired position without disassembling or removing the top operating components and top section of the hydrant standpipe.

7. The hydrant main valve shall be made of synthetic rubber and formed to fit the valve seat accurately. The hydrant valve shall be made from material that shall resist damage from rocks or other foreign matter. The valve shall be reversible. The hydrant shall be a true compression type, opening against pressure and closing with pressure.

8. The main valve seat shall be of bronze and its assembly into the hydrant shall involve bronze-to-bronze thread engagement. Two (2) "C" ring seals shall be provided as a positive pressure seal between the bronze seat ring and the shoe. The valve assembly pressure seals shall be obtained to allow without the employment of torque of torque compressed gaskets. The hydrant shall be designed to allow the removal of all operating parts through the hydrant barrel by means of a single, lightweight disassembly wrench without excavating.

9. The drain mechanism shall be designed to operate with the operation of the main valve and shall allow a momentary flushing of the drain ports. A minimum of two (2) internal and two (2) external bronze-lined drain pots shall be required in the main valve assembly to drain the hydrant barrel.

10. Cast iron inlet elbows shall have a six (6) inch mechanical joint connection complete with accessories.

11. Barrel extension sections shall be available in six (6) inch increments complete with rod, extension, coupling and the necessary flanges, gaskets and bolts, so that extending the hydrant can be accomplished without excavating. Hydrants shall have letters "AWB" cast in the barrel for identification purposes. Bury mark of fire hydrant shall be cast on barrel of the hydrant.

12. Hydrant shall have two (2) two and one-half (2½) inch hose nozzles one-hundred and twenty (120) degrees apart and one (1) four and one half (4½) inch pumper nozzle. The threads shall be national standard threads. The nozzle caps shall be secured to fire hydrant with non-kinking chain loop on cap ends to permit free turning of caps.

13. Bolts and nuts shall be corrosion resistant.

14. Hydrants shall be designed with safety flange to protect the barrel and stem from damage and to eliminate flooding of area when hydrant is struck or knocked off by vehicular equipment or other objects.

E. Setting Hydrants: Fire hydrants Traffic design.

1. Hydrants shall be placed at the locations indicated on the Plans in a manner to provide complete accessibility and so that the possibility of damage from vehicles or injury to pedestrians shall be minimized. The **Contractor** shall install proper "bury" hydrants or shall use, at no cost to the **County**, proper length extensions to ensure that each fire hydrant is installed in accordance with the manufacturer's recommendation and the requirements of these Specifications. When placed behind curb, the hydrant barrel shall be set such that no portion of the pumper or hose nozzle caps shall be less than six (6) inches, nor more than twelve (12) inches from the gutter face of the curb. The **Contractor** shall place gravel as shown on the Plans. All pipe connecting the fire hydrant to the main line shall be ductile iron pipe meeting the requirements of these Specifications or approved connecting pieces.

2. The use of PVC pipe for hydrant branch piping is specifically prohibited. The connection of the hydrant to the supply main shall be through either a ductile iron tee or a tapping sleeve and shall include an outlet valve at the point of connection. Using a tapping sleeve where the Plans indicate a tee shall not result in any additional costs to the **County**.

F. Connection to main: Each fire hydrant shall be connected to the main with a six (6) inch ductile iron branch connection. Gate valves shall be used on fire hydrant branches unless otherwise specified.

G. Drainage: Stone no larger than four (4) inches in diameter, shall be placed around the base of the fire hydrant for a depth of thirty (30) inches from the bottom of the trench and shall extend for a distance of thirty (30) inches from the back of the hydrant toward the main.

H. Anchoring and Bracing: The shoe of each fire hydrant shall be braced against unexcavated earth at the end of the trench with stone slabs or poured concrete; or it shall be tied to the pipe with suitable metal tie rods or clamps or both, as directed by the **County**. The straps and rods, nuts and threads, used for anchoring shall be coated with protective materials at the end of installation.

I. Painting, Coating, and Lubricating:

1. All iron parts of the hydrant inside and outside shall be cleaned and thereafter, unless otherwise stipulated, all surfaces, except the exterior portion above the ground line, shall be coated or painted with, or dipped in an asphalt or bituminous base paint or coating. If these parts are painted, they shall be covered with two (2) coats, the first being allowed to dry thoroughly before the second coat is applied.

2. The outside of the hydrant valve above the finished ground line shall be thoroughly cleaned and thereafter painted in the shop with two (2) coats of Koppers primer 621or approved equal. After installation, each hydrant shall be painted with two (2) field coats of Koppers Glamortex Enamel as manufactured by the Sika Inertol Company or approved equal, color shall be silver. The top cap of each hydrant shall be painted in one of the following colors to indicate the main size: six (6) inch or eight (8) inch mains shall be silver; ten (10) inch or twelve (12) inch mains shall be yellow; and sixteen (16) inch or greater mains shall be green.

3. All bronze, threaded contact moving parts shall, during shop assembly, be lubricated, and protected by a coating of rustproof compound to prevent damage in shipment and storage.

J. Accessories: The **Contractor** shall furnish one (1) standard four (4) sided hydrant wrench for each ten (10) hydrants installed or fraction thereof.

K. Testing: All fire hydrants shall be tested in strict accordance with the requirements of AWWA C502, with no additional cost to the **County**. The Certificate of Compliance shall be furnished to the **County**.

2.08 GATE VALVES (GV)

A. Twenty (20) Inches in Diameter and Smaller:

1. Gate valves shall be resilient-seated type conforming to the requirements of AWWA C509 or AWWA C515.

2. Valves through twelve (12) inches in diameter shall have a minimum rated working pressure of two hundred (200) psi. Sixteen (16) inch and twenty (20) inch valves shall have a minimum rated working pressure of one hundred and fifty (150) psi.

3. Valves less than four (4) inches in diameter shall have threaded ends. Larger valves shall be mechanical joint unless shown otherwise on the Plans.

4. Valves shall be non-rising stem type with a two (2) inch square wrench nut, and shall open left. The manufacturer shall provide an affidavit of compliance with the applicable AWWA standards.

5. All internal ferrous surfaces shall be coated with epoxy to a minimum thickness of four (4) mils. The epoxy shall be non-toxic, impart no taste to the water and shall conform to the requirements of AWWA C550.

6. All seals between valve parts, such as body and bonnet, bonnet and bonnet cover, shall be flat gaskets or O-rings.

7. Valve disks shall be made of cast or ductile iron having a vulcanized, synthetic rubber coating.

8. Valves shall be manufactured by American Flow Control, Mueller, or M & H Valve.

B. Twenty-four (24) Inches in Diameter and Larger:

1. Valves shall be double disc type conforming to the requirements of AWWA C500.

2. Valves shall be designed for horizontal installation with tracks and rollers, bypass valves, and bevel gear type operator. Valves shall be rated for one-hundred and fifty (150) psi working pressure.

3. Valve ends shall be mechanical joint type except where restrained joint ends are shown. Flanged joints shall meet the requirements of ANSI B16.1, Class 125.

4. Buried valves shall be equipped with valve boxes unless access to the operator is provided by a manhole.

5. Manually operated valves, including geared valves, shall be non-rising stem type having O-ring seals.

6. Gate valves twenty four (24) inches in diameter and larger shall be manufactured by American R/D Gate Valve Company, Mueller, M & H Valve, or approved equal.

2.09 BUTTERFLY VALVES (BV)

A. Butterfly Valves shall not be installed.

2.10 VALVE MARKERS (VM)

A. The **Contractor** shall provide a concrete valve marker as detailed on the Plans for each valve installed, except on hydrant isolation valves. Valve markers shall be stamped “WATER.”

2.11 TAPPING SLEEVES AND VALVES (TS&V)

A. Tapping sleeves for mains twelve (12) inches in diameter and smaller shall be ductile iron of the split sleeve, mechanical joint type. Tapping sleeves shall be equal to Mueller H-615.

B. Tapping sleeves for mains larger than twelve (12) inches shall be of all stainless steel construction.

C. The **Contractor** shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve. The tapping sleeve shall be rated for two-hundred and fifty (250) psi.

D. Valves shall be gate valves furnished in accordance with the specifications shown above, with flanged connection to the tapping sleeve and mechanical joint connection to the branch pipe. The tapping sleeve shall be supplied by the valve manufacturer.

2.12 CORPORATION COCKS AND CURB STOPS

A. Corporation cocks and curb stops shall be ball type, shall be made of bronze conforming to the requirements of ASTM B61 or ASTM B62, and shall be suitable for the working pressure of the system. Ends shall be suitable for flared tube joint. Threaded ends for inlet and outlet of corporation cocks shall conform to the requirements of AWWA C800; coupling nut for connection to flared copper tubing shall conform to the requirements of ANSI B16.26. Corporation cocks and curb stops shall be manufactured by Mueller, Ford FB-600, or equal.

PART 3 - EXECUTION

3.01 EXISTING UTILITIES AND OBSTRUCTIONS

A. The Plans indicate utilities or obstructions that are known to exist according to the best information available. The **Contractor** shall call the Utilities Protection Center (UPC) (800 282 7411) as required by Georgia Law (O.C.G.A. Sections 25 9 1 through 25 9 13) and shall call all utilities, agencies, or departments that own and/or operate utilities in the vicinity of the construction work site at least seventy-two (72) hours [three (3) business days] prior to construction to verify the location of the existing utilities.

B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service:

1. The **Contractor** shall provide the required notice to the utility owners and allow them to locate their facilities according to Georgia law. Field utility locations are valid for only ten (10) days after original notice. The **Contractor** shall ensure at the time of any excavation that a valid utility location exists at the point of excavation.

2. The **Contractor** shall expose the facility, for a distance of at least two-hundred (200) feet in advance of pipeline construction, to verify its true location and grade. The **Contractor** shall repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.

3. The **Contractor** shall avoid utility damage and interruption by protection with means or methods recommended by the utility owner.

4. The **Contractor** shall maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any. The **Contractor** shall provide the **County** with an updated copy of the log biweekly, or more frequently if required by the **County**.

C. Conflict with Existing Utilities:

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed water main does not permit safe installation of the water main by the use of sheeting, shoring, tying back, supporting, or temporarily suspending service of the parallel or crossing facility. The **Contractor** may change the proposed alignment of the water main to avoid horizontal conflicts if the new alignment remains within the available right of way or easement, complies with regulatory agency requirements and after a written request to and subsequent approval by the **County**. Where such relocation of the water main is denied by the **County**, the **Contractor** shall arrange to have the utility, main, or service relocated. The **Contractor** shall receive approval from the **County** for any utility relocation.

2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed water main does not permit the crossing without immediate or potential future damage to the utility, main, service, or the water main. The minimum clearance shall be twelve (12) inches. The **Contractor** may change the proposed grade of the water main to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the **County**. Where such relocation of the water main is denied by the **County**, the **Contractor** shall arrange to have the utility, main, or service relocated. The **Contractor** shall receive approval from the **County** for any utility relocation.

D. Electronic Locator: The **Contractor** shall have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

E. Water and Sewer Line Separation:

1. Water mains shall maintain a minimum ten (10) foot edge-to-edge separation from sewer lines, whether gravity or pressure. If the main cannot be installed in the prescribed easement or right-of-way and provide

the ten (10) foot separation, the separation may be reduced, provided the bottom of the water main is a minimum of eighteen (18) inches above the top of the sewer. Should neither of these two separation criteria be possible, the water main shall be installed below the sewer with a minimum vertical separation of eighteen (18) inches.

2. The water main, when installed below the sewer, shall be encased in concrete with a minimum six (6) inch concrete depth, to the first joint in each direction. Where water mains cross the sewer, the pipe joint adjacent to the pipe crossing the sewer shall be cut to provide maximum separation of the pipe joints from the sewer.

3. No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.

3.02 CONSTRUCTION ALONG HIGHWAYS, STREETS, AND ROADWAYS

A. The **Contractor** shall install pipe lines and appurtenances along highways, streets, and roadways in accordance with the applicable regulations of, and permits issued by, the Georgia Department of Transportation (GDOT) or applicable permitting authority and the **County** with reference to construction operations, safety, traffic control, road maintenance, and repair.

B. Traffic Control: Shall meet the requirements of **Section 01550 - Temporary Facilities** and as stipulated below.

1. The **Contractor** shall provide, erect, and maintain all necessary barricades, suitable and sufficient lights and other traffic control devices; provide qualified flagmen where necessary to direct traffic; take all necessary precautions for the protection of the Work and the safety of the public. Flagmen shall be certified by a GDOT-approved training program.

2. Construction traffic control devices and their installation shall be in accordance with the current Manual on Uniform Traffic Control Devices for Streets and Highways.

3. Placement and removal of construction traffic control devices shall be coordinated with GDOT and the **County** a minimum of forty eight (48) hours in advance of the activity.

4. Placement of construction traffic control devices shall be scheduled ahead of associated construction activities. Construction time in street right of way shall be conducted to minimize the length of time traffic is disrupted. Construction traffic control devices shall be removed immediately following their useful purpose. Traffic control devices used intermittently, such as “Flagmen Ahead,” shall be removed and replaced when needed.

5. Existing traffic control devices within the construction work zone shall be protected from damage. Traffic control devices requiring temporary relocation shall be located as near as possible to their original vertical and horizontal locations. Original locations shall be measured from reference points and recorded in a log prior to relocation. Temporary locations shall provide the same visibility to affected traffic as the original location. Relocated traffic control devices shall be reinstalled in their original locations as soon as practical following construction.

6. Construction traffic control devices shall be maintained in good repair and shall be clean and visible to affected traffic for daytime and nighttime operation. Traffic control devices affected by the construction work zone shall be inspected daily.

7. Construction warning signs shall be black legend on an orange background. Regulatory signs shall be black legend on a white background. Construction sign panels shall meet the minimum reflective requirements of GDOT and the **County**. Sign panels shall be of durable materials capable of maintaining their color, reflective character, and legibility during the period of construction.

8. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the Manual on Uniform Traffic Control Devices for Streets and Highways, as appropriate for the speed limit at that location. Channelization devices shall be patrolled to insure that they are maintained in the proper position throughout their period of use.

C. Construction Operations:

1. The **Contractor** shall perform all work along highways, streets, and roadways to minimize interference with traffic.

2. Stripping: Where the pipe line is laid along road right of way, the **Contractor** shall strip and stockpile all sod, topsoil, and other material suitable for right of way restoration.

3. Trenching, Laying and Backfilling: The **Contractor** shall not open the trench any further ahead of pipe laying operations than is necessary. The **Contractor** shall backfill and remove excess material immediately behind laying operations. The **Contractor** shall complete excavation and backfill for any portion of the trench in the same day.

4. Shaping: The **Contractor** shall reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. The **Contractor** shall replace topsoil, sod, and any other materials removed from shoulders.

5. Construction operations shall be limited to four hundred (400) feet along areas, including clean up and utility exploration.

D. Excavated Materials: The **Contractor** shall not place excavated material along highways, streets, and roadways in a manner that obstructs traffic. The **Contractor** shall sweep all scattered excavated material off the pavement in a timely manner meeting all Erosion and Sedimentation requirements of **Section 02125 - Temporary and Permanent Erosion and Sediment Control**.

E. Drainage Structures: The **Contractor** shall keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff. E&S measures shall be maintained and the **Contractor** is subject to clean any storm line and MH that has received siltation.

F. Landscaping Features: Landscaping features shall include, but are not necessarily limited to: fences; property corners; cultivated trees and shrubbery; manmade improvements; subdivision and other signs within the right of way and easement. The **Contractor** shall take extreme care in moving landscape features and promptly reestablish these features.

G. Maintaining Highways, Streets, Roadways, and Driveways:

1. The **Contractor** shall maintain streets, highways, roadways, and driveways in suitable condition for movement of traffic until completion and final acceptance of the Work.

2. During the time period between pavement removal and completing permanent pavement replacement, the **Contractor** shall maintain highways, streets, and roadways by the use of steel running plates. Running plate edges shall have asphalt placed around their periphery to minimize vehicular impact. The backfill above the pipe shall be compacted as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.

3. The **Contractor** shall furnish a road grader or front end loader for maintaining highways, streets, and roadways. The grader or front end loader shall be available at all times.

4. The **Contractor** shall immediately repair all driveways that are cut or damaged and the **Contractor** shall maintain them in a suitable condition for use until completion and final acceptance of the Work.

3.03 PIPE DISTRIBUTION

A. Pipe shall be distributed and placed in such a manner that shall not interfere with traffic.

B. No pipe shall be strung further along the route than one-thousand (1,000) feet beyond the area in which the **Contractor** is actually working without written permission from the **County**. The **County** reserves the right to reduce this distance to a maximum distance of two-hundred (200) feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.

C. No street or roadway shall be closed for unloading of pipe without first obtaining permission from the proper authorities. The **Contractor** shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets, and roadways upon which pipe is distributed.

D. No distributed pipe shall be placed inside drainage ditches.

E. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five (5) feet from the roadway pavement, as measured edge to edge.

3.04 LAYING AND JOINTING PIPE AND ACCESSORIES

A. The **Contractor** shall lay all pipe and fittings to accurately conform to the lines and grades established by the **County**.

B. Pipe Installation:

1. Pipe shall be installed in accordance with the requirements of AWWA M11, Chapter 16. Welded joints shall be in accordance with the requirements of AWWA C206.

2. Sleeve-type mechanical pipe couplings shall conform to the requirements of AWWA M11.

3. Unless otherwise specified, buried mechanical couplings and valves shall be field coated as shown on the Plans, specified in these Specifications, or as directed by the **County**.

4. Anchorage shall be provided as shown on the Plans, specified in these Specifications, or as directed by the **County**.

5. Proper implements, tools, and facilities shall be provided for the safe performance of the Work. All pipe, fittings, valves, and hydrants shall be lowered carefully into the trench by means of slings, ropes, or other suitable tools or equipment in such a manner as to prevent damage to water main materials and protective coatings and linings. Under no

circumstances shall water main materials be dropped or dumped into the trench.

6. All pipe, fittings, valves, hydrants, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be rejected by the **County** and replaced at the **Contractor** or manufacturer's expense.

7. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe containing dirt shall be laid.

8. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing, or other materials shall be placed in the pipe at any time.

9. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

10. It is not mandatory to lay pipe with the bells facing the direction in which work is progressing.

11. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade, shall not be permitted.

12. The **Contractor** shall provide detection tape for all pipe greater than twelve (12) inches in diameter. Detection tape shall be buried four (4) to ten (10) inches deep. Should detection tape need to be installed deeper, the **Contractor** shall provide three (3) inch wide tape. In no case shall detection tape be buried greater than twenty (20) inches from the finish grade surface.

C. Alignment and Gradient:

1. The **Contractor** shall lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. The **Contractor** shall not deflect any joint more than the maximum deflection recommended by the manufacturer.

2. The **Contractor** shall maintain a transit, level, and accessories on the site of the Work to lay out angles and ensure that deflection allowances are not exceeded.

D. Expediting of Work: The **Contractor** shall excavate, lay the pipe, and backfill as closely together as possible. The **Contractor** shall not leave un-jointed pipe in the trench overnight. The **Contractor** shall backfill and compact the trench as soon as possible after laying and jointing is completed. The **Contractor** shall backfill the installed pipe each day at the close of work and at all other times when work is not in progress. No excavation is to be left unbackfilled or unsupervised. If necessary to backfill over the end of an uncompleted pipe or accessory, the **Contractor** shall close the end with a suitable plug, either push on, mechanical joint, restrained joint, or as approved by the **County**.

E. Joint Assembly:

1. Push-on, mechanical, flange, and restrained-type joints shall be assembled in accordance with the manufacturer's recommendations.

2. The **Contractor** shall inspect each pipe joint within one-thousand (1,000) feet on either side of main line valves to insure one-hundred (100) percent seating of the pipe spigot, except as noted otherwise.

3. Each restrained joint shall be inspected by the **Contractor** to ensure that it has been “homed” one-hundred (100) percent.

4. The **Contractor** shall internally inspect each pipe joint to insure proper assembly for pipe twenty four (24) inches in diameter and larger after the pipe has been brought to final alignment.

F. Cutting Pipe: The **Contractor** shall cut ductile iron pipe using an abrasive wheel saw. The **Contractor** shall cut PVC pipe using a suitable saw; remove all burrs, and smooth the end before jointing. The **Contractor** shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories, and closure pieces in the correct location. Only push on or mechanical joint pipe shall be cut.

G. Polyethylene Encasement: Installation shall be in accordance with the requirements of AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the **County**.

H. Valve and Fitting Installation:

1. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves shall be rejected by the **County** and replaced at the **Contractor’s** or manufacturer’s expense. Valves shall be closed before being installed.

2. Valves, fittings, plugs, and caps shall be set and joined to the pipe in the manner specified in this section for cleaning, laying and joining pipe, except that twelve (12) inch and larger valves shall be provided with special support, such as crushed stone, concrete pads, or a sufficiently tamped trench bottom, so that the pipe shall not be required to support the weight of the valve. Valves shall be installed in the closed position.

3. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut, and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads shall bear on the base and not on the valve or pipe. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the **County**.

4. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.

5. A valve marker shall be provided for each underground valve. Unless otherwise detailed on the Plans or directed by the **County**, valve markers shall be installed six (6) inches inside the right of way or easement, and buried to a depth of thirty (30) inches as per Standard Detail No. W-8

I. Air Valve Vaults:

1. The **Contractor** shall construct the vault or manhole as detailed on the Plans.

2. The frame and cover shall be cast into the top slab. The floor drain shall be piped to vault exterior.

3. Manholes shall be constructed such that their walls are plumb.

3.05 CONNECTIONS TO EXISTING WATER MAINS

A. The **Contractor** shall make connections to existing pipelines with tapping sleeves and valves, unless specifically shown otherwise on the Plans. Before connecting to any existing water main, the **Contractor** shall receive approval from the **County**.

B. Location: Before laying pipe, the **Contractor** shall locate the points of connection to existing water mains and uncover as necessary for the **County** to confirm the nature of the connection to be made.

C. Interruption of Services: The **Contractor** shall make connections to existing water mains only when system operations permit and only when notices are issued to the customer. The **Contractor** shall operate existing valves only with the specific authorization and direct supervision of the **County**.

D. Tapping Sleeves:

1. Holes in the new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be permitted.

2. Prior to attaching sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.

3. Before performing field machine cut, the water tightness of the sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with water. An air compressor shall be attached to induce a test pressure as specified in this section. No leakage shall be permitted for a period of five (5) minutes.

4. After attaching the sleeve to an existing main, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to potable water shall be swabbed or sprayed with a one (1) percent sodium hypochlorite solution.

E. Connections Using Solid Sleeves: Where connections are shown on the Plans using solid sleeves, the **Contractor** shall furnish materials and labor necessary to make the connection to the existing pipe line.

F. Connections Using Couplings: Where connections are shown on the Plans using couplings, the **Contractor** shall furnish materials and labor necessary to make the connection to the existing pipe line, including all necessary cutting, plugging, and backfill.

G. Transfer of Service: Immediately before connecting to the relocated or existing meter, all service lines shall be flushed to remove any foreign matter. All special fittings required to reconnect the existing meter to the new copper service line, or the existing private service line, shall be provided by the **Contractor**. To minimize out-of-service time, the **Contractor** shall determine the connections to be made and have all the required pipe and fittings on hand before shutting off the existing service. After completing the connection, the new corporation stop shall be opened and all visible leaks shall be repaired.

3.06 THRUST RESTRAINT

A. The **Contractor** shall provide restraint at all points where hydraulic thrust may develop.

B. Retainer Glands: The **Contractor** shall provide retainer glands where shown on the Plans. Retainer glands shall be installed in accordance with the manufacturer's recommendations, particularly, the required torque of the set screws. The **Contractor** shall furnish a torque wrench to verify the torque on all set screws that do not have inherent torque indicators.

C. Harnessing:

1. The **Contractor** shall provide harness rods only where specifically shown on the Plans or directed by the **County**.

2. Harness rods shall be manufactured in accordance with the requirements of ASTM A36 and shall have an allowable tensile stress of no less than 22,000 psi. Harness rods shall be hot dip galvanized or field coated with bitumastic before backfilling.

3. Where possible, harness rods shall be installed through the mechanical joint bolt holes. Where it is not possible, the **Contractor** shall provide ninety (90) degree bend eye bolts.

4. Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe size. The eye shall be welded closed. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod. Eye bolts shall be of the same material and coating as the harness rods.

D. Thrust Collars: Collars shall be constructed as shown on the Plans. Concrete and reinforcing steel shall meet the requirements of **Sections 03200 - Concrete Reinforcement** and **Section 03300 - Cast-In-Place Concrete**. Welded-on collar shall be designed to meet the minimum allowable load shown on the Plans. The welded-on collar shall be attached to the pipe by the pipe manufacturer.

E. Concrete Blocking as required and approved by the **County**:

1. The **Contractor** shall provide concrete blocking for all bends, tees, valves, and other points where thrust may develop in addition to thrust restraint as per Standard Detail No. W-36.

2. Concrete shall be as specified in **Section 03300 - Cast-In-Place Concrete**.

3. The **Contractor** shall form and pour concrete blocking at fittings as shown on the Standard Details and as directed by the **County**. The **Contractor** shall pour blocking against undisturbed earth. The **Contractor** shall increase dimensions when required by over excavation.

3.07 INSPECTION AND TESTING

A. All sections of the water main subject to internal pressure shall be pressure-tested in accordance with the requirements of AWWA C600 and these Specifications. A section of main shall be considered ready for testing after completion and curing of all thrust restraint and backfilling.

B. Water used for testing mains and washing streets will be made available to the **Contractor** at the nearest existing **County DWM** facilities. The **Contractor** shall furnish all necessary pipe or hose extensions and transportation to the point of use and exercise care in use of the water. Water used for other purposes shall be supplied through a metered connection, which the **Contractor** shall obtain through the **County DWM** Applications Office.

C. Each segment of water main between main valves shall be tested individually.

D. Test Preparation:

1. For water mains less than twenty four (24) inches in diameter, the **Contractor** shall flush sections thoroughly at flow velocities, greater than two and one-half (2½) feet per second, adequate to remove debris from pipe and valve seats. For water mains twenty four (24) inches in diameter and larger, the main shall be carefully swept clean, and mopped if directed by the **County**. The **Contractor** shall partially open valves to allow the water to flush the valve seat.

2. The **Contractor** shall partially operate valves and hydrants to clean out seats.

3. The **Contractor** shall provide temporary blocking, bulkheads, flanges, and plugs as necessary, to assure all new pipe, valves, and appurtenances shall be pressure tested.

4. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. The **Contractor** shall insert corporation cocks at highpoints to expel air as main is filled with water as necessary to supplement automatic air valves. Corporation stops shall be constructed as shown on the Standard Details with a meter box.

5. The **Contractor** shall fill pipeline slowly with water. The **Contractor** shall provide a suitable pump with an accurate water meter to pump the line to the specified pressure.

6. The differential pressure across a valve or hydrant shall equal the maximum possible, but not exceed the rated working pressure of the

system. Where necessary, the **Contractor** shall provide temporary backpressure to meet the differential pressure restrictions.

7. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure.

E. Test Pressure: The **Contractor** shall test the pipeline at two-hundred and fifty (250) psi measured at the lowest point for at least two (2) hours. The **Contractor** shall maintain the test pressure within five (5) psi of the specified test pressure for the test duration. Should the pressure drop more than five (5) psi at any time during the test period, the pressure shall be restored to the specified test pressure. The **Contractor** shall provide an accurate pressure gauge with graduation not greater than five (5) psi.

F. Leakage:

1. Leakage shall be defined as the sum of the quantity of water that shall be pumped into the test section, to maintain pressure within five (5) psi of the specified test pressure for the test duration plus water required to return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter.

2. The **County** assumes no responsibility for leakage occurring through existing valves.

G. Test Results: No test section shall be accepted if the leakage exceeds the limits determined by the following formula:

$$L = \frac{SD\,(P)1/2}{133{,}200}$$

Where: L = Allowable leakage, in gallons per hour

S = Length of pipe tested, in feet

D = Nominal diameter of the pipe, in inches

P = Average pressure during the test (psi, gauge)

As determined under Section 4 of AWWA C600.

H. If the water main section being tested contains lengths of various pipe diameters, the allowable leakage shall be the sum of the computed leakage for each diameter. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results at the **Contractor's** expense.

I. Completion: After a pipeline section has been accepted, the **Contractor** shall relieve test pressure. The **Contractor** shall record type, size, and location of all outlets on the Record Drawings.

3.08 DISINFECTING PIPELINE

A. After successfully pressure testing each pipeline section, the **Contractor** shall disinfect in accordance with the requirements of AWWA C651 for the continuous feed method and these Specifications.

B. Specialty **Contractor**: Disinfection shall be performed by an approved specialty **Contractor**. Before disinfection is performed, the **Contractor** shall submit a written procedure for approval before being permitted to proceed with the disinfection. This plan shall also include the steps to be taken for the neutralization of the chlorinated water. The **Contractor** shall receive approval from the **County** where to dispose of chlorinated water.

C. Chlorination:

1. The **Contractor** shall apply chlorine solution to achieve a concentration of at least twenty-five (25) milligrams per liter free chlorine in new line. The **Contractor** shall retain chlorinated water for twenty-four (24) hours. Water shall be supplied from a temporary source protected by appropriate backflow prevention devices. Backflow preventer shall be approved by the **County** prior to connection. Chlorine shall be injected no more than ten (10) feet from the beginning of the new main.

2. Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the twenty four (24) hour period.

3. After twenty four (24) hours, all samples of water shall contain at least ten (10) milligrams per liter free chlorine. The **Contractor** shall rechlorinate if the required results are not obtained on all samples.

D. Disposal of Chlorinated Water: The **Contractor** shall reduce chlorine residual of disinfection water to less than one (1) milligram per liter if discharged directly to a body of water or to less than two (2) milligrams per liter if discharged onto the ground prior to disposal. The **Contractor** shall treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. The **Contractor** shall flush all lines until residual is equal to existing system.

E. Bacteriological Testing: After final flushing and before the water main is placed in service, the **Contractor** shall collect samples from the line and have them tested for bacteriological quality in accordance with the rules of the Georgia Department of Natural Resources, Environmental Protection Division. The **County** reserves the right to collect and test the samples in the **County**'s laboratory. One (1) set of samples shall be collected from every

one-thousand and two-hundred (1,200) feet of water main, plus one (1) set from each end of main and one (1) set from each branch. If the test results are not acceptable, the **Contractor** shall re-chlorinate lines at its cost until required results are obtained.

3.09 PROTECTION AND RESTORATION OF WORK AREA

A. General: The **Contractor** shall return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is completed. Restoration of streets, sidewalks, curb, and driveways shall comply with **Section 02510 - Pavement Repairs** and **02521 - Concrete Sidewalks, Curbs, and Gutters**. Restoration of off-street areas shall comply with the requirements of **Section 02920 - Site Restoration** and as stipulated below.

1. The **Contractor** shall plan, coordinate, and prosecute the work such that disruption to personal property and business is held to a practical minimum.

2. All construction areas abutting lawns and yards of residential or commercial property shall be restored promptly. Backfilling of underground facilities, ditches, and disturbed areas shall be accomplished on a daily basis as work is completed. Finishing, dressing, and grassing shall be accomplished immediately thereafter, as a continuous operation within each area being constructed and with emphasis placed on completing each individual yard or business frontage. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

3. Handwork, including raking and smoothing, shall be required to ensure that the removal of roots, sticks, rocks, and other debris is removed in order to provide a neat and pleasing appearance.

4. The **County** shall be authorized to stop all work by the **Contractor** when restoration and cleanup are unsatisfactory and to require appropriate remedial measures.

B. Man-Made Improvements: The **Contractor** shall protect, or remove and replace with the **County**'s approval, all fences, walkways, mail boxes, pipe lines, drain culverts, power and telephone lines and cables, property pins, and other improvements that may be encountered in the Work.

C. Cultivated Growth: The **Contractor** shall not disturb cultivated trees or shrubbery unless approved by the **County**. All such trees or shrubbery that must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.

D. Cutting of Trees: The **Contractor** shall not cut trees for the performance of the Work except as absolutely necessary and with the approval from the **County.** The **Contractor** shall protect trees that remain in the vicinity of the work from damage from equipment. The **Contractor** shall not store spoil from excavation against the trunks. The **Contractor** shall remove excavated material stored over the root system of trees within thirty (30) days to allow proper natural watering of the root system. The **Contractor** shall repair any damaged tree over three (3) inches in diameter, not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the site of the Work and disposed of by the **Contractor** in a lawful manner. No stumps, wood piles, or trash piles shall be permitted on the site of the Work.

E. Disposal of Rubbish: The **Contractor** shall dispose of all materials cleared and grubbed during the construction of the Project in accordance with the applicable codes and rules of the appropriate Federal, State, and local regulatory agencies.

F. Wetlands:

1. The **Contractor** shall not construct permanent roadbeds, berms, drainage structures, or any other structures that alter the original topographic features within the easement.

2. All temporary construction or alterations to the original topography shall incorporate measures to prevent erosion into the surrounding wetland. All areas within the easement shall be returned to their original topographic condition as soon as possible after work is completed in the area. All materials of construction and other non-native materials shall be disposed by the **Contractor**.

3. The **Contractor** shall provide temporary culverts or other drainage structures, as necessary, to permit the free migration of water between portions of a swamp, wetland, or stream that may be temporarily divided by construction.

4. The **Contractor** shall not spread, discharge, or dump any fuel oil, gasoline, pesticide, or any other pollutant to adjacent swamps or wetlands.

3.10 ABANDONING EXISTING WATER MAINS

A. General: The **Contractor** shall abandon in place all existing water main segments indicated on the Plans to be abandoned. The **Contractor** shall perform abandonment after the new water main has been placed in service and all water main services have been changed over to the new main. The **Contractor** shall salvage for the **County** existing fire hydrants, valve boxes, valve markers, and other materials located on the abandoned water mains.

B. Capping and Plugging: The **Contractor** shall disconnect by sawing or cutting and removing a segment of existing pipe where cutting and capping or plugging is directed by the **County**. The **Contractor** shall provide a watertight pipe cap or plug and concrete blocking for restraint to seal off existing mains indicated to remain in service. The **Contractor** shall seal ends of existing mains to be abandoned with a pipe cap or plug or with a masonry plug and minimum six- (6-) inch cover of concrete on all sides around the end of the pipe. The **Contractor** shall be responsible for uncovering and verifying the size and material of the existing main to be capped or plugged. The abandoned pipeline shall be filled with flowable fill if directed by the **County**.

C. Salvaging Materials: The **Contractor** shall salvage existing fire hydrants, valve boxes, valve markers, and other materials located of water mains abandoned and deliver salvaged items in good condition to the **County**'s storage yard. The **Contractor** shall coordinate delivery and placement of salvaged materials in advance with the **County**.

D. Pavement Removal and Replacement: The **Contractor** shall perform any necessary pavement removal and replacement in accordance with **Section 02510 - Pavement Repairs** and the approved plans.

END OF SECTION

SECTION 02711
FENCING AND GATES

PART 1 - GENERAL

1.01 SCOPE

A. Work described in this Section includes furnishing all labor, materials, equipment, tools, and incidentals required for a complete installation of chain link fence and gates. All materials shall be installed and adjusted, in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings.

B. Contract drawings show only functional features and some of the required external connections. They do not show all components required for a complete installation nor exact dimensions particular to any manufacturer's products. **Contractor** shall supply all parts, devices, and equipment necessary to meet the requirements of the Contract Documents and shall make all dimensional adjustments particular to the materials being furnished. All costs associated with such changes and adjustments shall be considered as being included in the price bid for the Work shown and specified.

C. Related Work specified elsewhere:

Section 03300 – Cast-in-Place Concrete

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300.

1.03 QUALITY ASSURANCE

A. Reference Standards: Comply with all Federal and State laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:

1. Department of Transportation Standard Specifications for Construction of Roads and Bridges, Sections 643 and 894.

B. Experience: Products furnished under this Section shall be of a design and manufacture that has been successfully used in similar applications. The manufacturer shall have furnished product for a minimum of five similar applications. Provide a list of such installations complete with installation description contact names, addresses, telephone numbers. This reference list shall be submitted with the shop drawings.

1.04 QUALITY STANDARDS

A. The chain link fence and gates shall be furnished by a single manufacturer who

shall assume sole responsibility for providing a complete system designed for long life with a minimum of required maintenance meeting the requirements specified herein and as shown on the Drawings.

B. Manufacturer shall provide written certification that the material provided under this Specification has been amply designed and is a suitable application for these service conditions.

C. Manufacturer's offering products that comply with these specifications include:

Anchor Fence, Inc. or Approved equal.

1.05 WARRANTY

A. Provide a warranty against defective materials and workmanship in accordance with the requirements of the General Requirements of the Contract Documents.

PART 2 - PRODUCTS

2.01 GENERAL

A. Zinc and aluminum coated steel and aluminum alloy fabric, posts, fittings and accessories, shall conform to AASHTO M 181.

2.02 FENCE FABRIC

A. All chain link fence shall consist of woven wire in the form of reasonably uniform two (2) inch-square mesh, having parallel sides and horizontal and vertical diagonals of approximately uniform dimensions. The wire size shall be as specified on the Drawings.

B. TYPES

1. Zinc-Coated Steel Fabric: The base metal of the fabric shall be a good commercial quality of steel wire coated with prime western spelter or better (AASHTO: M120) applied at the rate of not less than 1.2 oz. of zinc per square foot of uncoated wire surface after weaving.

- OR -

2. Aluminum-Coated Steel Fabric: The base metal of the fabric shall be a good commercial quality steel wire, coated with aluminum alloy applied at the rate of not less than 0.40 oz. per square foot of uncoated wire surface.

C. Workmanship: Chain Link fence fabric shall be produced by methods recognized as good commercial practices. The zinc or aluminum coating shall be applied to the fabric in a continuous process and shall not be applied to the fabric in roll form. Both coated before weaving and coated after weaving fabric shall be given careful visual inspection to determine the quality of the coating. Excessive roughness, blisters, sal ammoniac spots, bruises, flaking bare spots, or other obvious defects, to any considerable extent, shall be cause for rejection.

1. Tolerances: All dimensions, weights, and test methods shall conform to the applicable portions of AASHTO: M 181 or Federal Specification RR-F-191.

2.03 POSTS

A. Line Posts shall be:

1. One and seven-eighths (1 7/8) inch nominal galvanized steel "H" column minimum weight of two and seven-tenths (2.70) pounds per linear foot, or
2. Nominal two and three-eighths (2 3/8) inches outside diameter galvanized steel pipe minimum weight three and sixty-five hundredths (3.65) pounds per linear foot, or
3. "C" section channels measuring two and twenty-five hundredths by one and seventy hundredths (2.25" x 1.70") inches, minimum weight of two and seventy-three hundredths (2.73) pounds per linear foot.

B. End, Corner, and Pull Posts:

1. Zinc and aluminum-coated posts shall be:
   a. Nominal two and seven eighths (2-7/8) inches outside diameter galvanized steel pipe weighing a minimum of five and seventy-nine hundredths (5.79) pounds per linear foot, or
   b. Two and one half (2-1/2) inch-square posts with a minimum weight of five and seventy hundredths (5.70) pounds per linear foot, or
   c. Three and one-half by three and one half (3-1/2 x 3-1/2) inches rolled form sections with integral fabric loops, weighing a minimum of five and fourteen hundredths (5.14) pounds per linear foot.

2.04 TOP RAILS AND HORIZONTAL BRACES FOR END, CORNER AND PULL POSTS

A. Truss Bracing shall be three-eighths (3/8) inch round rod with suitable turnbuckle or takeup arrangement. Rods shall be of the approximate metal and coating according to the type of fence installation. All braces shall be furnished with suitable metal connections so that they can be securely fastened to the posts.

B. Top rail shall be furnished in lengths of not less than fifteen (15) feet. Each section shall be provided with a suitable expansion sleeve or coupling not less than seven (7) inches long. Every fifth coupling as installed shall have a heavy spring to take up expansion and contraction of the top rail.

C. Zinc and aluminum coated rails and braces shall be nominal:
1. One and five-eighths (1-5/8) inch outside diameter steel pipe, minimum weight of two and twenty-seven hundredths (2.27) pounds per linear foot, or
2. One and five-eighths by one and one-quarter (1-5/8 x 1-1/4) inches roll formed sections weighing a minimum of one and thirty-five hundredths (1.35) pounds per linear foot.

2.05 POST TOPS AND FITTINGS

A. All posts shall be fitted with tops designed to fit securely over the posts and carry the top rail. The tops and fittings shall be of dimensions shown on the Drawings.

2.06 FABRIC FASTENERS

A. Wire for fabric fasteners may be zinc coated or aluminum coated of the gauges specified.

2.07 GATES

A. Frames, Posts, hinges, and fitting shall be in accordance with dimensions shown in Federal Specification RR-F-191, unless otherwise specified.

1. Gates: Shall be provided with combination spring latch and plunger rod of approved design for padlocking.

2. Hinges: Heavy-duty malleable iron or steel, industrial service type, two hundred and seventy (270) degree swing. Provide at least three (3) hinges on each gate leaf at vehicular gate openings.

3. Hold-Open Device: Equip designated gate openings with galvanized steel or malleable iron stop/hold open devices with catch or plunger rod of standard manufacture and approved design.

2.08 BARBED WIRE

A. Galvanized steel barb wire shall be composed of two strands of No. 12 1/2 gauge wire with round barbs, four-point pattern, spaced five plus and minus one-half (5±1/2) inch apart conforming to ASTM: A 121, Class 2, or at the **Contractor's** option may be high tensile strength barbed wire. If the **Contractor** elects to furnish high tensile strength bared wire, it shall meet the requirements of ASTM: A 121 with the following exceptions:

1. The coated line wires shall have a nominal diameter of 0.067 inch. The coated barbwires shall have a nominal diameter of 0.057 inch.

2. The minimum weight of zinc coating shall be seventy-five hundredths (0.75) ounces per square foot for the line wire and seventy hundredths (0.70) ounces per square foot for the barbed wire.

3. The line wire shall have a minimum tensile strength of four hundred seventy-five (475) pounds per individual strand.

2.09 GROUND RODS

A. Ground Rods shall be five-eighths (5/8) inch in diameter but no less than nine-sixteenths (9/16) inch and shall be minimum eight (8) feet in length unless otherwise shown on the Plans. Ground rods shall be galvanized steel. Galvanizing shall have a minimum coating of two (2) ounces per square foot in

accordance with the requirements of ASTM: A 153.

PART 3 - EXECUTION:

3.01 GENERAL

A. Fence shall normally be constructed within the right-of-way line with no portion of the permanent installation encroaching on adjacent property. When it is necessary for the **Contractor** to trespass on private property outside of the right-of-way or easements provided on the Drawings, the **Contractor** shall obtain permission from the property owner for such intrusion.

B. Fence shall generally follow the contour of the ground, with the bottom of fence fabric no less than one inch or more than six inches from the ground surface. The fence line shall be cleared a maximum of eight (8) feet wide and minor grading shall be performed where necessary to provide a neat appearance. Where abrupt changes in the ground profile in low areas make it impractical to maintain the specified ground clearance, longer posts may be used and multiple strands of barbed wire stretched thereon with vertical clearances between strands of barbed wire six (6) inches or less.

C. Any of the various types of fencing materials shown in Part 2, may be used, except that posts, fabric, barbed wire, and appurtenances, including gates when required, shall be of the same or matching type for each Project, unless otherwise directed.

3.02 INSTALLATION

A. Posts shall be located and installed as called for on the Drawings. "C" and two and three-eighths (2 3/8) inch tube-type line posts for all types of fences shall be installed using concrete encasement. Posts installed in rock shall be in accordance with Article 643.03.B.3 of the DOT Standard Specifications.

1. All corner, end, and pull posts shall have concrete encasement as shown in the Drawings. Posts damaged by driving shall be replaced by the **Contractor** at its expense. When posts are set in concrete, the entire hole around the post shall be filled with Class A or B concrete. Concrete may be hand mixed for batches of one-half (1/2) cubic yard or less. The posts shall be firmly braced and held in place until the concrete has set. Distance between end, pull, and corner or angle post assemblies, shall not exceed the following:

   For Chain Link Fence, Straight Line: five hundred (500) feet
   For Chain Link Fence, Curved Line: two hundred fifty (250) feet

2. Posts placed on concrete walls, slabs or solid rock shall be set in round holes twelve (12) inches deep or as indicated on the Drawings. The space around the post shall be filled with a cement filler approved by the **County**.

3. Posts shall be repaired after cutting or drilling. Galvanized steel posts shall be repaired in accordance with the manufacturer's recommendations.

B. Fence Erection; Fence fabric or barbed wire, except when posts are set in concrete footings, may be installed when posts are set and braced. When posts are set in concrete footings, the installation of fabric or wire shall be delayed to allow the concrete to cure at least five (5) days. When barbed wire fence is required, three strands shall be installed unless otherwise indicated on the Drawings.

C. Gates: Gate assemblies shall be of the length, height and type designated on the Drawings, and installed so as to provide for two hundred seventy (270) degree swing. Gate frames shall be welded units and shall be properly coated after welding. Fabric matching the fence fabric shall be stretched taut over the gate frame. Gate assemblies shall be provided with a positive type locking device, padlock, and keys.

D. Electrical Ground: Whenever a power line carrying more than six hundred (600) volts passes over the fence, a ground rod shall be installed. The ground rod shall be installed at the nearest point directly below the point of crossing. Where possible the ground rod shall be driven into the ground for a full eight (8) feet of penetration. In rocky soil, the rod may be driven slanted, so as to provide eighteen (18) inches of cover at the tip. If solid rock is encountered, two (2) ground rods may be installed at the nearest post on each side of the power line crossing where soil conditions will permit. A length of No. 6 bare copper seven (7) stranded wire shall be attached between the fence and the ground rod with suitable clamps.

3.03 STORAGE OF MATERIALS

A. Barbed wire, wire fence fabric, steel posts, hardware, and other materials, shall not be stored in contact with the ground but shall be placed in floored buildings, on platforms, or on wooden timbers or poles. Floors, platforms, or props shall be high enough to prevent the wire and steel posts from having any contact with the groundwater or surface water. Wire or steel posts that are damaged due to improper storage at any time between fabrication and final erection shall be rejected. Except when rusting occurs as a result of ponding water after erection of the fence, all wire or posts that show signs of rusting before final acceptance shall be repaired, as directed by the **County**, or removed and replaced with new material at the **Contractor's** expense.

+++ END OF SECTION 02711 +++

SECTION 02750
BYPASS PUMPING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Work described in this Section includes furnishing all materials, labor, equipment, and incidentals required to install, test, and maintain a temporary bypass pumping system for the purpose of diverting all wastewater flows around the Work area.

B. The objectives of flow bypass and/or diversion pumping are to:

1. Maintain an efficient and uninterrupted level of service to wastewater collection system users while replacement, cleaning or internal condition assessment operations are facilitated on the segment or segments being bypassed and/or from which flow is being diverted, within the wastewater collection system

2. Ensure all levels of wastewater flow are continuously and effectively handled around the segment or segments of sewer being bypassed and/or from which flow is being diverted by:

a. Providing odor control measures and systems to contain and control odors at the intake and discharge manholes or other locations

b. Ensuring that bypass and diversion pumps are adequately fueled, lubricated, and maintained

c. Ensuring that backup spare parts are expeditiously installed in the flow bypass and/or diversion pumping system in the event of component breakdown

d. Ensuring an emergency response plan is smoothly implemented in the event of system failure

e. Preventing backup, spillage, flooding or overflow onto streets, yards and unpaved areas or into buildings, adjacent ditches, storm drains, and waterways, while flow bypass or diversion pumping takes place and ensuring that installation, startup and subsequent disassembly of the flow bypass and diversion pumping system is smoothly transitioned

C. At all times during pumping operations, an experienced bypass/diversion pump maintenance operator/mechanic and/or assistant shall continuously be on site to monitor the operation of the entire bypass/diversion system. The operator/mechanic and/or assistant shall comprehensively and continuously:

1. Adjust pump speed as appropriate so as not to adversely impact upstream or downstream flow condition levels.
2. Check that the bulkheads, dams, diaphragms, plugs, valves, weirs, and all other flow control devices are working effectively and according to plan.
3. Check the integrity of hoses and couplings along the entire bypass / diversion system.
4. Monitor fuel tanks and refuel as necessary.
5. Monitor lubrication levels and provide additional lubrication as necessary.
6. Facilitate minor repairs as required.
7. Report to the **County** on potential problems.
8. Inspect bypass-pumping system at least hourly to ensure that the system is working correctly.
9. Maintain adequate supply of spare parts on site as required.
10. Monitor and maintain odor control facilities and systems.

D. Bypass pumping systems shall include a minimum of one thousand (1,000) lineal feet discharge piping length.

E. Related Work Specified Elsewhere

1. Section 01010 - Project Procedures
2. Section 02920 - Site Restoration

1.02 UNIT RESPONSIBILITY

A. Bypass pumps, piping, and associated accessories shall be provided by a single supplier to ensure a completely integrated and functional system and temporary HDPE piping systems shall be tested for leakage prior to use.

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300 - Submittals

B. The design, installation, and operation of the temporary pumping system shall be the **Contractor's** responsibility. The **Contractor** shall employ the services of a vendor that can demonstrate to the **County** that the vendor specializes in the design and operation of temporary bypass pumping systems. The vendor shall provide at least three (3) references of projects of a similar size and complexity as this Project, successfully performed by the vendor's firm within the past three years. Each reference shall include the name of the agency, the name of the project, the date of the project, and the agency contact (telephone, fax, and e-mail). The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

C. During the course of the project, the detailed, Work-Specific Bypass Pumping/Flow Diversion Plan for any bypass utilizing multiple pumps, or a single pump greater than or equal to a four (4) inch discharge, shall be submitted to the

County at least ten (10) days before required. The plan shall outline all provisions and precautions, to be taken by the **Contractor**, regarding the handling of existing wastewater flows and control of odors. The plan shall be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials, and all other incidental items necessary and/or required to insure proper protection of the facilities and control of odors. The Plan shall also include details of protection of the access and bypass pumping locations from damage due to the discharge flows, compliance with the requirements, and permit conditions specified in these Contract Documents. No Work shall begin until all provisions and requirements have been reviewed and authorized by the **County**.

D. The **Contractor** shall submit two (2) copies of the Flow Bypass Pumping/Flow Diversion Plan, described in Item 1.03(C), for each sewer bypass set up with sufficient detail to show:

1. Staging areas for pumps
2. Sewer plugging method and types of plugs
3. Number, size, material, location, and method of installation of suction piping including manhole cone removal and reconstruction
4. By-pass pump sizing criteria (i.e., force main size and length, static and dynamic head, flow velocity, maximum wastewater level depths in manholes upstream of bypass pump operations), and resulting capacity, number of each size to be on site, and power/fuel requirements
5. Calculations for selection of bypass pump size and pump curves showing the pump operating range
6. Standby power generator size, location
7. Downstream discharge plan
8. Method of protecting discharge manholes or structures from erosion and damage, including manhole cone removal and reconstruction
9. Thrust and restraint block sizes and locations
10. Sections showing suction and discharge pipe depth, embedment, select fill, and special backfill where required
11. Method of noise control for each pump and/or generator
12. Any temporary pipe supports, including rollers and elevated rollers, as well as anchoring required
13. Design plans and computation for access to bypass pumping locations indicated on the drawings
14. Schedule for installation of and maintenance of bypass pumping lines
15. Plan indicating selected location of bypass pumping lines
16. Plan indicating the means by which flows from service laterals shall be accommodated
17. Plan for maintaining traffic access to private property and public streets

E. All proposed flow control arrangements, including flow bypass and/or diversion pumping plans for sewers, shall also include an emergency response plan to be followed in the event of a failure of the bypass pumping and/or diversion system.

F. The **Contractor** shall notify the **County** twenty-four (24) hours prior to commencing actual flow bypass and/or diversion pumping operations. The **Contractor's** Bypass Pumping/Flow Diversion Plan and Emergency Response Plan shall be agreed to by the **County** before the **Contractor** is allowed to commence wastewater bypass pumping and/or diversion.

1.04 ENVIRONMENTAL PROTECTION

A. The **Contractor** shall take necessary precautions to ensure that bypass operations do not result in wastewater overflows, sewer backups, odors, or related threats to the public health and do not cause flooding or damage to public or private property.

B. The pumped wastewater shall be in an enclosed hose or pipe that is adequately protected from traffic and shall be redirected to the sanitary sewer system. The dumping or free flow of wastewater on public and private property, gutters, streets, sidewalks, or into storm drains is prohibited. Open channels or trenches shall not be used to convey wastewater flow.

C. Should any liquid or solid matter from the wastewater collection system be spilled, discharged, leaked, or otherwise deposited to the environment, the **Contractor** shall immediately notify the **County,** clean, and disinfect the affected area to meet minimum state and local standards. In addition, due care and attention shall be provided to prevent the leakage of pump fuel or lubrication oil.

D. Any wastewater overflows, backups, leaks, odors, or property damage resulting from improper setup or failure of the bypass pumping system shall be the responsibility of the **Contractor**. The **Contractor** shall be responsible for any fines, for the complete cleanup of such spills, and for all restoration of any damaged property at no additional cost to the **County**.

PART 2 - PRODUCTS

2.01 BYPASS PUMPS

A. The bypass pumps used shall be fully automatic, self-priming units. The pumps shall possess dry-running capabilities to accommodate the diurnal, cyclic nature of wastewater flow.

B. Bypass pumps shall be of sufficient capacity to accommodate the daily peak sanitary sewer flows plus any additional flows due to rain events.

C. The bypass pumps shall be driven by either electric motor or diesel engine.

1. Diesel engines shall be provided with acoustic enclosures to minimize noise.

2. The **Contractor** is responsible for providing all necessary and required power and control wiring and associated electrical devices when using electric motors.

D. Unless otherwise specified or approved by the **County**, the pumping equipment shall be sound attenuated; noise levels shall not exceed seventy-five (75) decibels at twenty-three (23) feet.

E. The **Contractor** shall also provide a backup, onsite, bypass pumping system that shall automatically energize upon a high-water level, indicating the failure of the primary bypass pumping unit. The backup system shall be equal in all respects to the primary system.

F. The Bypass Pumping system shall be equipped with an electronic remote monitoring device that will notify the **Contractor** and the pump operator in the event of a high-water level condition or a malfunction or failure of the bypass pumping system.

G. The bypass pump equipment supplier shall provide technical support and service twenty-four (24) hours/day, seven (7) days/week.

2.02 SYSTEM DESCRIPTION

A. Design Requirements:

1. Bypass pumping systems shall have sufficient capacity to pump a peak flow in the pipes that are being replaced, cleaned, or inspected. The **Contractor** shall provide all pipeline plugs, pumps of adequate size to handle wet weather peak flows, and temporary discharge piping to ensure that the total flow of the main can be safely diverted around the section to be replaced, cleaned, or inspected. The bypass pumping system shall be designed to be operated twenty-four (24) hours per day.

2. The **Contractor** shall have adequate standby equipment available and be ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.

3. The **Contractor** shall make all arrangements for bypass pumping during the time when the main is shut down for any reason. System shall overcome any existing force main pressure on discharge if applicable.

B. Performance Requirements:

1. To prevent interruption in the flow of wastewater, the **Contractor** shall, throughout the duration of the project, provide, maintain, and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as required), piping, conduits, all necessary power, and all other labor and equipment necessary to intercept the wastewater flow before it reaches the point where it would interfere with its work, carry it past its work, and return it to the existing sewer downstream of its Work.

2. The **Contractor** shall meet the requirements of all codes and regulatory agencies having jurisdiction over the design, installation, and operation of the temporary pumping system. The bypass systems shall be the **Contractor's** responsibility.

3. The **Contractor** shall provide all necessary means to safely convey the wastewater past the Work area. The **Contractor** shall not be permitted to stop or impede the main flows under any circumstances.

4. The **Contractor** shall maintain wastewater flow around the Work area in a manner that will not cause surcharging of or damage to sewers and that shall protect public and private property from damage and flooding.

5. The **Contractor** shall protect water resources, wetlands and other natural resources.

PART 3 - EXECUTION

3.01 PLANNING

A. The **Contractor** shall be solely responsible for planning and executing wastewater flow control, bypass, and diversion pumping operations. The **Contractor** shall be entirely liable for damages to private or public property that may result from its operations and for all cleanup, disinfection, damages, and resultant fines in the event of a spillage, flooding or overflow.

B. The **Contractor** shall coordinate the bypass pump installation and start-up with the **County**.

1. A minimum of forty-eight (48) hours advance written notice shall be given before starting bypass operations. The bypass pumping system shall be tested for a minimum of twenty-four (24) hours without incident prior to taking any part of the collection system, including pump stations, out of service. Should any incident occur, the test period shall be restarted. Bypass operations shall not start or restart on Fridays.

2. The **County** reserves the right to delay the start of bypass operations (e.g., in the event of forecasted adverse weather).

3.02 GENERAL

A. Precautions:

1. The **Contractor** is responsible for locating any existing utilities in the area the **Contractor** selects to locate the bypass pipelines. The **Contractor** shall locate the bypass pipelines to minimize any disturbances to existing utilities and shall obtain approval of the pipeline locations from the **County**. Costs associated with relocating utilities and obtaining approvals shall be paid by the **Contractor**.

2. During all bypass pumping operations, the **Contractor** shall protect sewer lines and manholes from damage caused by any equipment. The **Contractor** shall be responsible for all physical damage caused by its activities.

3.03 PLUGGING OR BLOCKING

A. The **Contractor** shall insert sewer line plug into the line at a manhole upstream from the manhole or sewer that is to be cleaned or inspected. Flow-through plugs shall be used in the manhole or sewer that is to be cleaned or inspected where possible to save on discharge piping and the environment.

B. Plugging or blocking of wastewater flows shall incorporate primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance or work, it is to be removed in a manner that permits the wastewater flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.

3.04 FLOW BYPASS AND/OR DIVERSION PUMPING SCHEDULING

A. If the **County** is operating or maintaining conventional pumping facilities and/or flow bypass and/or diversion pumping in the construction area of the present Contract, the **Contractor** shall coordinate with the **County** as necessary to determine and effect optimum working arrangements.

B. The **Contractor** shall immediately cease bypass and/or diversion pumping when so ordered by the **County**.

3.05 PIPE RESIDUE

A. When flow bypass and diversion pumping operations are complete, the residual contents of wastewater in piping shall be drained into the existing sewer prior to disassembly.

+++END OF SECTION 02750+++

SECTION 02920
SITE RESTORATION

PART 1 - GENERAL

1.01 SCOPE

A. This section includes disposition of materials and structures encountered in the Work; ground preparation; mulching; seeding; fence reset; cleanup; and any other similar, incidental, or appurtenant operation that may be necessary to properly complete the Work.

B. The **Contractor** shall provide all services, labor, materials, and equipment required for all site restoration and related operations necessary or convenient to the **Contractor** for furnishing a complete Work as shown on the Plans or specified in these Specifications.

C. Related Work Specified Elsewhere:

1. Section 01210 - Measurement and Payment
2. Section 02200 - Earthwork
3. Section 02231 - Tree Protection and Trimming
4. Section 02324 - Trenching and Trench Backfilling
5. Section 02510 - Pavement Repairs
6. Not Used

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Requirements of the Contract Documents and Section 01300. In addition, the following specific information shall be provided:

1. Certificates of inspection as required by government authorities. The **Contractor** shall submit manufacturers' or vendors' certified analysis for soil amendments and fertilizer materials. The **Contractor** shall submit other data substantiating that materials comply with specified requirements.

2. Typewritten instructions recommending procedures to be established by the **County** for maintenance of site restoration work for one (1) full year.

3. Seed vendors certified statements for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed for each grass seed species.

4. Proposed planting schedules, indicating dates for each type of planting work during normal seasons for such work in the site of the Work. The

Contractor shall correlate with specified maintenance periods to provide maintenance from the Date of Substantial Completion. Once accepted, the **Contractor** shall revise dates only as approved in writing, after documentation of reasons for delays.

1.03 QUALITY ASSURANCE

A. Reference Standards: The **Contractor** shall comply with the applicable provisions and recommendations of the latest editions of the following standards, except as otherwise shown on the Plans or specified in these Specifications.

1. ASTM C602 - Standard Specification for Agricultural Liming Materials.
2. Turfgrass Producers International.

B. The **Contractor** shall ship site restoration materials with certificates of inspection required by authorities having jurisdiction. The **Contractor** shall comply with regulations applicable to site restoration materials.

C. If specified site restoration materials are not obtainable, the **Contractor** shall submit proof of non-availability to the **County** together with proposal for use of equivalent material.

D. The **Contractor** shall package standard products with manufacturers' certified analysis. For other material, the **Contractor** shall provide analysis by recognized laboratory, in accordance with methods established by the Association of Official Agricultural Chemists, as applicable.

1.04 SAFETY REQUIREMENTS

A. Hazards Control:

1. The **Contractor** shall store volatile wastes in covered metal containers, and remove from the site of the Work daily.

2. The **Contractor** shall prevent accumulation of wastes that create hazardous conditions.

3. The **Contractor** shall provide adequate ventilation during use of volatile or noxious substances.

B. The **Contractor** shall conduct cleaning and disposal operations in compliance with local ordinances and environmental laws and regulations.

1. The **Contractor** shall not burn or bury rubbish and waste materials on the site of the Work without prior written permission from the **County**.

2. The **Contractor** shall not dispose of volatile wastes such as mineral spirits, oil, or fuel in open drainage ditches or storm or sanitary drains.

1.05 DELIVERY

A. The **Contractor** shall deliver packaged materials in containers showing weight, analysis, and name of manufacturer. The **Contractor** shall protect materials from deterioration during delivery, and while stored at the site of the Work.

1.06 JOB CONDITIONS

A. All bare earth areas within the limit of work shall be grassed, mulched, or covered with other plant material as shown on the Plans. Final restoration of existing lawn areas (i.e. private residences, schools, and parks) shall be sod.

B. On a continuous basis, the **Contractor** shall maintain the site of the Work free from accumulations of waste, debris, and rubbish caused by its operations.

C. At completion of the Work, the **Contractor** shall remove waste materials, rubbish, tools, equipment, machinery, and surplus materials, and clean all sight-exposed surfaces. The **Contractor** shall leave the site of the Work clean and ready for occupancy.

D. The **Contractor** shall proceed with the complete site restoration work as rapidly as portions of the site of the Work become available, working within seasonal limitations for each kind of site restoration work required. The **Contractor** shall not be allowed to postpone cleanup and seeding until the end of the Work.

E. The **Contractor** shall determine the locations of underground utilities and perform Work in a manner that shall avoid possible damage. The **Contractor** shall hand excavate, as required. The **Contractor** shall maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

F. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, the **Contractor** shall notify the **County** before planting.

G. The **Contractor** shall install materials during normal planting seasons for each type of site restoration work.

H. The **Contractor** shall plant trees and shrubs after final grades are established and prior to planting of lawns, unless otherwise acceptable to the **County**. If planting of trees and shrubs occurs after lawn work, the **Contractor** shall protect lawn areas and promptly repair damage to lawns resulting from planting operations.

I. The **Contractor** may, at its option, employ additional measures (other than those specified) to prevent loss of, or damage to the Work resulting from the effects of wind and/or water. No additional compensation shall be made for the employment of such additional measures.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Topsoil for site restoration may not be available at the site of the Work in sufficient quantities and shall be furnished as specified.

B. New topsoil shall be fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay, lumps, brush, weeds, and other litter, and free of roots, stumps, stones, and other extraneous or toxic matter harmful to plant growth.

C. The **Contractor** shall obtain topsoil from local sources or from areas having similar soil characteristics to that found at the site of the Work. The **Contractor** shall obtain topsoil only from naturally, well-drained sites where topsoil occurs in depths of not less than four (4) inches. The **Contractor** shall not obtain topsoil from bogs or marshes.

2.02 MATERIALS

A. Grass seed shall meet the requirements of the State of Georgia Seed Laws and Rules and Regulations except that the requirements as to purity, germination, and noxious weeds shall be specified in this section.

1. Quality: Grass seed quality shall be as shown in the Table below:

Grass Seed Quality			
Seed	Purity Min. %	Germination Min %	Noxious Weed Max. Per Lb.
Sahara Bermuda Grass	98	90	None
Annual Rye Grass	98	90	None
Rebel II Turf Type Fescue	85	85	None

2. Seed shall be approved by the **County** before sowing. Seed shall have been tested by the Georgia Department of Agriculture, and no seed shall be acceptable with a date of test more than six (6) months prior to the date of sowing. Such testing, however, shall not relieve the **Contractor** from responsibility for furnishing and sowing seed that meet the requirements of these Specifications at the time of sowing seed. When required by the **County**, samples of seed shall be furnished by the **Contractor** early enough before seeding to permit further testing before the seed is used. When a low percentage of germination causes the quality of the seed to fall below the minimum pure live seed specified, the **Contractor** may choose to increase the rate of seeding to obtain the minimum pure live seed content specified, provided that such an increase in seeding rates does not cause the quantity of noxious weed seed per square yard to exceed the quantity that would be allowable at the regular rate of seeding.

3. Seed that has become wet, moldy, or otherwise damaged shall not be acceptable.

B. All fertilizer shall be of the grades specified and shall meet the requirements of the State Plant Food Act in effect thirty (30) days prior to the taking of bids. It shall be uniform in composition, dry and free flowing and shall be delivered to the site of the Work in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer that is caked or otherwise damaged, making it unsuitable for use, shall not be accepted.

C. Mulch shall meet the following requirements:

1. Be acceptable to the **County**.
2. Be of such consistency that, when properly loosened, it can be distributed in a uniform application.
3. Be capable of producing the desired results.
4. Meet State and Federal Quarantine Restrictions pertaining to fire ants, Japanese beetles, and white fringed beetles.
5. Shall have a moisture content of twelve (12) percent or less.
6. Contain no excessive amounts of noxious weed seeds.
7. All materials shall carry the following certification: "This material is certified as free for movement under the State and Federal Imported Fire Ant, Japanese Beetle, and White Fringed Beetle Quarantines."
8. Mulch shall be threshed rye, oat straw, wheat straw, or Bermuda grass hay.

D. Agricultural lime shall be a pulverized limestone having the following properties:

1. Total carbonate, not less than eighty-five (85) percent.
2. Passing ten (10) mesh screen at least one hundred (100) percent.
3. Passing one hundred (100) mesh screen at least twenty-five (25) percent.

E. Hydro mulch: Wood cellulose fiber containing no germination, inhibiting, or growth inhibiting agent. Characteristics shall be as follows:

1. Percent moisture content: Nine (9.0%) percent ± 3.0 percent.
2. Percent organic matter: Nine and two-tenths (9.2%) percent ± 0.8 percent.
3. Percent ash content: One and eight-hundredths (1.08%) percent ± 0.2 percent.
4. pH: four and eight tenths (4.8) (± 0.5).
5. Water holding capacity: one thousand one hundred fifty (1150) grams water/ one hundred (100) grams fiber minimum.

F. Sod. Sod shall meet the requirements of Georgia Department of Transportation Standard Specifications Construction of Transportation Systems, Section 700 and 890, latest edition.

2.03 GRASSING

A. Grass seed shall be as specified on the table below depending on the season or as instructed by the **County**. See the table below for seasonal application rates:

Seasonal Seed Application Rates		
Season	**Type of Seed**	**Application: lbs. per Acre**
Jan. 1 – May 15	Rebel II Turf Type Fescue	250
May 16 – Sept. 15	Sahara Hybrid Bermuda Grass	75
Sept. 16 – Dec. 31	Rebel II Turf Type Fescue	250

B. Disturbed Area Stabilization (Temporary Seeding) shall be planted with seeds listed in Table 2.

PART 3 - EXECUTION

3.01 DISPOSITION OF MATERIALS AND STRUCTURES ENCOUNTERED IN THE WORK

A. Existing materials or structures that may be encountered (within the lines, grades, or trenching sections established for completion of the Work), if unsuitable or unacceptable to the **County** for use in the Work, and for which the disposition is not otherwise specified, shall either be disposed of by the **Contractor** or shall remain the property of the **County** as further provided in this section.

B. At the option of the **County**, any existing materials or structures of "value" encountered in the Work shall remain the property of the **County**. The term "value" will be defined by the **County**.

C. Any existing materials or structures encountered in the Work, and determined not to be of "value" by the **County**, shall be disposed of by the **Contractor**, in an approved manner, except as otherwise specified in Section 02200 - Earthwork

3.02 GROUND PREPARATION

A. All ground to be sodded, sprigged, overseeded, or grassed shall be prepared by plowing, disking, and harrowing to a depth or not less than six (6) inches. After plowing, topsoil shall be spread on the prepared area to a depth of four (4) inches, and smoothed to a uniform depth. The finished surfaces shall present a smooth, uniform, loose, well broken soil. All large clods, boulders, stumps, large roots, roots, debris, and other particles two (2) inches in diameter or greater and which will interfere with the Work shall be removed from the site of the Work.

B. Lime shall be uniformly spread over the area to be planted or sowed at the rate of two thousand (2,000) pounds per acre. Commercial grade five (5) percent nitrogen-ten percent phosphorus – ten percent potassium (5-10-10) fertilizer or approved equal shall also be uniformly spread over the area at the rate of one thousand five hundred (1,500) pounds per acre or as recommended by the manufacturer. The fertilizer and the lime shall then be thoroughly mixed into the

top six (6) inches of the soil. All surface areas distorted by mixing of line and fertilizer into the soil shall be restored to the proper line and grade before any more work is done on the area.

3.03 MULCHING

A. The quantity of mulch to be applied shall be that required to evenly cover the ground to a depth of at least three (3) quarters of an inch and not more than one and one-half (1½) inches, according to the texture and moisture content of the mulch material. It is intended that mulch allow some sunlight to penetrate and air to circulate while at the same time shading the ground and conserving soil moisture.

B. Mulch: Mulch shall be uniformly applied manually or with special blower equipment. When a blower is used, baled material shall be thoroughly loosened before it is fed into the machine so as to obtain a uniform coating of mulch and to prevent placement of unbroken clumps. After initial distribution, thick clumps that are dense enough to prevent new grass from emerging shall be loosened and redistributed. Mulch shall not be applied on windy days when the velocity of the wind is sufficient to prevent uniform distribution of mulch.

C. Hydro mulch: If Hydro mulch is used, it shall be mixed to provide equivalent quantities of fertilizer and seed as specified in this section.

3.04 SEEDING

A. Seed shall be uniformly sown at the rates specified, by the use of approved mechanical seed drills, rotary hand seeders, or other type of equipment that shall produce a uniform application of the seed. The **Contractor** shall not distribute seed by hand.

B. In order to obtain an even distribution, seeds shall be sown separately except that seeds of approximately the same size may be mixed and sown together. No sowing shall be done during windy weather that prevents even distribution of the seeds, when the prepared surface is crusted, frozen, wet, or otherwise in non-tillable condition.

C. Immediately after seeding, all areas shall be rolled.

D. Watering: After seeding of areas are complete, watering shall be continued daily as long as necessary to promote a rapid growth except that no water shall be applied between the hours of 10 A.M. and 4 P.M. to prevent “crushing over” from the sun.

E. First Application of Nitrogen (All areas): The first application of nitrogen shall be made on all areas when there is evidence that a satisfactory stand of grass will be obtained. For seeded areas, the young grass shall have reached a height of at least one (1) inch. At this time, nitrate of soda, or other approved commercial fertilizer high in nitrogen content shall be applied at a rate sufficient to furnish

seventy (70) pounds of nitrogen per acre. No fertilizer shall be applied to unsatisfactory areas that will have to be replanted.

F. Second Application of Nitrogen (all areas): A second application of nitrogen shall be made thirty (30) days after sufficient moisture has been applied to make the first application available for plant growth. Second application shall also furnish seventy (70) pounds nitrogen per acre.

G. Maintenance: The **Contractor** shall provide all maintenance necessary to keep all seeded and turf areas in a healthy, satisfactory, and weed-free condition until the Work is finally accepted. This includes repairing washed-out areas, and correctly applying additional seed, fertilizer, and water if they are needed.

H. Satisfactory Stand Defined:

1. A stand of grass shall be considered satisfactory by the **County** only if there is full cover over the seeded area with perennial grass that is alive and growing, leaving no bare spots larger than one (1) square foot or the total of all bare spots within a given area shall constitute no more than one one-hundredth (1/100) of the total area.

2. If it is necessary to repeat any or all of the work necessary to produce a viable stand of perennial grass, including repairing washed-out areas, soil preparation, re-fertilizing, liming, re-seeding, sprigging, watering, or mulching, the **Contractor** shall repeat these operations until satisfactory stand is obtained and approved by the **County**.

I. The **Contractor** shall remove all stumps, fallen trees, uprooted trees, dead trees, and debris from the edge of the right-of-way.

3.05 SOD

A. Furnish and install sod in all lawn areas or as designated by the **County**.

1. Use only Common Bermudagrass (Cynodon dactylon) or one of the following Bermudagrass varieties:
   a. Tifway 419
   b. Tifway II Hybrid
   c. Tift 94
   d. Tifton 10
   e. Midlawn
   f. Midiron
   g. GN-1 Hybrid
   h. Vermont

2. No dwarf Bermuda types shall be used. Sod shall be nursery-grown and accompanied with a Georgia Department of Agriculture Live Plant License Certificate or Stamp. Sod shall consist of live, dense, well-rooted material free of weeds and insects as described by the Georgia Live Plant Act.

3. Place sod by hand or by mechanical means so that joints are tightly abutted with no overlaps or gaps. Use soil to fill cracks between sod pieces, but do not smother the grass.

4. Once sod is placed and staked as necessary, tamp, or roll it using adequate equipment to provide good contact with soil.

5. Use caution to prevent tearing or displacement of sod during this process. Leave the finished surface of sodded areas smooth and uniform.

B. After the sod has been placed and rolled or tamped, water it to promote satisfactory growth. Additional watering will be needed in the absence of rainfall and during the hot, dry summer months. Water may be applied by Hydro Seeder, Water Truck or by other means approved by the **County**.

C. Sod will be inspected by the **County** at the end of the first spring after installation and at the time of Final Inspection. Replace any sod that is not live and growing. Any cost for replacing any unacceptable sod shall be at the **Contractor's** expense.

D. Apply nitrogen at approximately fifty (50) pounds/acre when specified by the **County** after plants have grown to two (2) inches high. One application is mandatory and shall be applied before Final Acceptance. Apply nitrogen with mechanical hand spreaders or other approved spreaders capable of uniformly covering the grassed areas. Do not apply nitrogen on windy days or when foliage is damp. Do not apply nitrogen between October 15 and March 15.

3.06 FENCE RESET

A. Should the construction of the sewer require or result in removal or damage to an existing fence, the **Contractor** shall replace the fence in kind to the satisfaction of the fence owner.

3.07 CLEANUP

A. During site restoration work, the **Contractor** shall keep pavements clean and the site of the Work in an orderly condition.

B. The **Contractor** shall protect site restoration work and materials from damage due to site restoration operations, operations by other contractors, and trades and trespassers. The **Contractor** shall maintain protection during installation and maintenance periods. The **Contractor** shall treat, repair, or replace damaged site restoration work as directed by the **County**.

C. Throughout the progress of the Work, the **Contractor** shall keep the construction area, including storage areas used by the **Contractor**, free from accumulations of waste material or rubbish, and shall keep its materials and equipment in a neat and orderly manner. Immediately upon completion of any section of the Work and before payment therefore has been made, the **Contractor** shall remove from

the site of the Work all construction equipment, temporary structures, and debris, and shall restore the site of the Work to a neat, workmanlike condition; the **Contractor** shall not remove barricades and warning and direction signs until directed by the **County**. The **Contractor** shall not postpone cleanup and seeding until the end of the Work. Waste materials shall be disposed of at locations satisfactory to the **County** or affected regulatory agencies.

D. After completion of all Work contemplated under the Contract and before final payment has been made, the **Contractor** shall make a final cleanup of each separate part of the Work; shall restore all surfaces to a neat and orderly condition; and shall remove all construction equipment, tools, and supplies.

3.08 INSPECTION AND ACCEPTANCE

A. When site restoration work is completed, including maintenance, the **County** will, upon request, make an inspection to determine acceptability.

B. Where inspected site restoration work does not comply with the requirements of the **County**, the **Contractor** shall replace rejected work and continue specified maintenance until reinspected by the **County** and found to be acceptable. The **Contractor** shall remove rejected plants and materials promptly from the site of the Work.

+++ END OF SECTION 02920 +++

SECTION 02956
SANITARY SEWER CLEANING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes specifications for sewer line cleaning to remove foreign materials and debris from the mains and restore the pipe to a minimum of 95% of the through flow channel and cross section, for clear viewing of the interior surfaces of the lines during television inspection, or as required for other specified rehabilitation or purpose.

1.02 RELATED SECTIONS

A. Section 02742: Sanitary Sewer Main Television and Sonar Inspection

1.03 REFERENCES

A. Codes, Specifications, and Standards

B. Testing and Materials Standards

1.04 SUBMITTALS

A. The **Contractor** shall submit to the Program Manager written documentation the supervisor and field crew leaders responsible for this work have received the proper training, are certified, and have the requisite experience. This documentation will include dates of hands-on experience, employer, description of duties/experience, contact name and phone number. Documentation on any person shall not be longer than 1-page.

B. Cleaning equipment and methods used.

C. Site specific cleaning plan/s.

1.05 PERSONNEL

A. The Supervisor must visit the project site daily checking on their personnel and subcontractors, meeting with the field crew leaders as well as checking on the status and progress of the project.

B. A field crew leader must be with their crew when their crew is working. Each field crew leader can only have one crew. Each crew must have its own field crew leader.

1.06 RESPONSIBILITY FOR OVERFLOWS/SPILLS AND DAMAGE TO PROPERTY AND UTILITY

A. Reference Specification Section 01100 – Special Project Procedures.

PART 2 - PRODUCTS

2.01 GENERAL

A. The **Contractor** shall provide all supervision, labor, material, supplies, equipment, transportation, traffic control, etc., necessary to satisfactorily clean the sewer main(s).

B. **Hydraulically Propelled Equipment:** The equipment used shall be of a movable dam type and be constructed so a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer. The movable dam shall be equal in diameter to the main being cleaned and shall provide a flexible scraper around the outer periphery to insure removal of grease. If sewer cleaning balls or other equipment, which cannot be collapsed, are used, special precautions to prevent flooding of the sewers and public or private property shall be taken.

C. **High-Velocity Jet (Hydrocleaning) Equipment:** All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size mains designated to be cleaned. Specialized nozzles capable of concentrating pressurized water either to the crown or lower quadrant of the pipe to be cleaned shall be available on site. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel.

D. **Mechanically Powered Equipment:** Bucket machines shall be in pairs with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an overload device. Machines with direct drive that could cause damage to the main will not be allowed. A power rodding machine shall be either a sectional or continuous rod type capable of holding a minimum of 500 feet of rod. The rod shall be specifically heat-treated steel. To insure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.

E. **Large Diameter Cleaning:** For cleaning large diameter sewer, storm or combination pipes, consideration should be given to a combination hydraulic high volume water and solids separation system. The flow from the sewer will provide water for the pump operation so no potable water is necessary and treatment costs are not a factor. Water volume of up to 250 GPM at 2000 psi+ will move solids to the downstream manhole in high flow conditions. The separation system will dewater solids to 95% (passing a paint filter test) and transfer them to a dump truck for transport to a sewage treatment plant or approved landfill. Sewer water will be

filtered to a point where it can be used in the pump for continuous cleaning. No by-passing of sewer flows will be necessary. The unit shall be capable of 24 hour operation and the unit shall not leave the manhole until a section is fully cleaned.

F. The flow of sewage in the sewer mains shall be utilized to provide the necessary pressures for hydraulic cleaning devices whenever possible. When additional quantities of water from fire hydrants are necessary to avoid delay in normal working procedures, the water shall be conserved and not used unnecessarily. The **Contractor's** truck/trailer must be permitted by the **County** as having the proper backflow prevention devices. The approval of the **County** shall be obtained before County water is used. Hydrants shall only be operated under the supervision of the **County**. **Contractor** shall be responsible for obtaining a hydrant meter from the **County** for this water use as directed by the Program Manager. **Contractor** shall be responsible for all costs associated with hydrant meter(s).

G. The **Contractor** shall be responsible for providing all other necessary hoses and tools for obtaining the water.

H. The **Contractor** is expected to have an easement machine available for use where required.

PART 3 - EXECUTION

3.01 GENERAL

A. **Cleaning Precautions:** During cleaning operations, satisfactory precautions shall be taken in the use of cleaning equipment. When hydraulically propelled cleaning tools (requiring water pressure to provide their cleaning force) or tools retarding the flow in the sewer main are used, precautions, including the direction of the cleaning operation, shall be taken to insure the water pressure created does not damage or cause flooding of public or private property being served by the pipe. Under the Consent Decree with EPA/EPD, work related building back-ups are reportable as spills.

B. **Cleaning:** The designated manhole sections shall be cleaned using hydraulically propelled, high-velocity jet, or mechanically powered equipment. Selection of the equipment used shall be based on the conditions of pipes at the time the work commences. The equipment and methods selected shall be satisfactory to the **County**. The equipment shall be capable of cleaning a minimum of 1200 linear feet and of removing dirt, grease, rocks, sand, and other materials and obstructions from the pipes and manholes. If cleaning an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted. Extreme care shall be taken when cleaning in a reverse setup so as not to cause flooding of service lines located along the sewer. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole

section, it will be assumed a major blockage exists and the cleaning effort shall be repeated with other types of equipment. All pipes shall be cleaned to the satisfaction of the **County**.

C. The term "clean", as used herein, shall mean the complete removal of all garbage, dirt, gravel, rocks, roots, grease, settled sludge and all other solid or semi-solid materials from the pipes and manholes.

1. Light Cleaning is defined as cleaning a pipe with an average depth of foreign material and debris equal to no more than 25% of the diameter of the main over the length of the manhole-to-manhole section. Rocks removed should be smaller than 3" in diameter.

2. Heavy Cleaning is defined as cleaning a pipe with an average depth of foreign material and debris equal to more than 25% of the diameter of the main over the length of the manhole-to-manhole section. Rocks removed should be larger than 3" in diameter. If a pipe is encountered requiring heavy cleaning, the **Contractor** shall notify the Program Manager of the problem before commencing work.

3. As part of both Light and Heavy Cleaning, the **Contractor** shall scour debris or grease-laden manhole walls with high velocity water gun. No additional cost will be paid for such scour.

D. Conditions, such as broken mains and major blockages, may prevent cleaning from being accomplished, especially where additional damage would result if cleaning were attempted, or continued. Should such conditions be encountered, the **Contractor** shall not be required to clean those specific main sections unless the **County** removes the apparent obstruction.

E. Whenever mains to be cleaned show evidence of being more than one-half filled with solids, bucket machines and/or rodding machines shall be utilized to remove the major portion of the material before hydraulic equipment or high velocity, hydro-cleaning equipment is brought into use for finishing the cleaning work.

1. When bucket machines are used, the bucketing process shall be done in one main section at a time. A bucket of the proper size shall be placed into the downstream manhole and pulled, in intervals, towards the upstream manhole.

2. The bucket shall be retrieved and emptied at varying intervals depending upon the amount of materials being removed. When a bucket is retrieved and it is completely full or overflowing with materials, then the length of travel into the main shall be reduced to ensure total removal of debris. This process shall be repeated until the bucket has been pulled through the entire main section. Upon completion of the bucketing or rodding operation,

hydraulically propelled cleaning equipment or high velocity hydro-cleaning equipment shall be used to complete the cleaning work.

F. **Root Removal:** Roots shall be removed from sections designated to be cleaned. Special attention shall be used during the cleaning operation to assure complete removal of roots from the joints. Procedures may include the use of mechanical equipment such as rodding machines, bucket machines and winches using root saws, chain-slingers, porcupines, and equipment such as high-velocity jet cleaners.

G. **Material Removal:** All sludge, dirt, sand, rocks, grease, and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing material from manhole section to manhole section, potentially causing main stoppages, accumulations of sand in wet wells, or damage pumping equipment, shall not be permitted.

H. **Disposal of Materials:** All solids, semisolids and/or liquids resulting from the cleaning operations shall be removed from the work site and disposed of at a site designated by the **County** and approved to accept wastewater debris and liquids. All materials shall be removed from the site no less often than at the end of each workday. Under no circumstances will the **Contractor** be allowed to accumulate debris, etc., on the site of work beyond the stated time, except in totally enclosed containers and as approved by the **County**. **Under no circumstances shall removed debris and/or liquids be dumped onto the ground or streets or into ditches, catch basins or storm drains for any length of time.** **Contractor** shall be responsible for legally disposing all debris and all disposal costs.

I. **Protruding Tap Removal:** Service taps extending into the pipe shall be removed by means of hydraulically or mechanically operated equipment. Chain cutters, clamshell cutters, and robotic lateral reinstatement cutters are typical equipment used to remove protruding taps. Taps should be removed so the resulting protrusion is less than 1” at the greatest point, or 10% of sewer main diameter, whichever is smaller. All debris resulting from protruding tap removal shall be removed immediately from the pipe. Where protruding taps are vitrified clay, grinding wheels may be used on lateral reinstatement cutters to insure a smooth finish. Where protruding taps prevent the passage of equipment through the pipe, notify the **County** immediately for point repair execution. Note: All protruding taps must be verified via television inspection prior to inserting any type of cutting tool into the main.

J. **Grease Removal:** Grease shall be removed in designated sections where grease is a known problem and shall be considered part of the cleaning procedures. The **Contractor** shall provide a list of lines requiring grease removal to the **County** and the Project Manager so they may be added to the **County’s** on-going maintenance list. Special attention should be given during the cleaning operations to ensure the complete removal of grease from the top of the pipe. Procedures may include the

use of mechanical equipment such as rodding machines, bucket machines and winches using root cutter and porcupines, and equipment such as high-velocity jet cleaners, and hot water. Chemical means of grease removal will be allowed upon request by the **Contractor**; however, it is considered subsidiary to Line Cleaning, and no additional payment will be allowed.

3.02 ACCEPTANCE

A. Acceptance of pipe cleaning shall be made upon the successful completion of the television/sonar inspection indicating a minimum of 95% of the through flow channel and cross section. If the inspection shows the cleaning to be unsatisfactory, the **Contractor** shall be required to reclean and reinspect the pipe, at no additional cost to the **County**, until the cleaning is shown to be satisfactory.

3.03 CLEANING PRECAUTIONS

A. Bucket machines or rodding machines shall be used very carefully because of their tendency to "hang-up" on or "wedge against" the sewer main and break it. Only experienced and well-trained operators shall operate the machines(s).

B. Whenever hydraulically propelled cleaning tools, or high velocity, hydro-cleaning equipment or any tools retarding the flow of water in the sewer mains are used, precautions shall be taken to ensure the water pressure created does not cause any damage or flooding to public or private property being served by the main involved.

C. Any damage to the sewer mains caused by the **Contractor's** operations shall be repaired in a manner approved by the **County** at the **Contractor's** expense. The **County** reserves the right to make said repairs itself and charge the **Contractor** accordingly.

D. Damage due to flooding of any public or private property being served by any main over-filled by **Contractor's** cleaning operations shall also be cleaned, sanitized and repaired or otherwise paid for by the **Contractor**.

3.04 PUBLIC NOTIFICATION – CLEANING

A. Public notification is critical and compliance with the public notification criteria is a prerequisite for sanitary sewer cleaning, especially when conducting cleaning on sewers in easements which pass through private property. Notification must be provided to all property occupiers/owners likely to be affected including residential, commercial and institutional (schools, hospitals, nursing homes, etc.). At a minimum, the following steps shall be taken:

1. The **Contractor** shall print and distribute pre-approved advance notice door hangers 72 hours before conducting sanitary sewer cleaning. The **Contractor** shall distribute the door hangers to the

property owners (residential, commercial and institutional) in the affected area(s). The advance notice door hangers shall be customized by Public Outreach to suit this project and will be provided to the **Contractor** for printing prior to project commencement. If cleaning efforts are delayed, the **Contractor** must re-distribute door hangers.

a. The **Contractor** is responsible for distributing pre-approved "Right-of-Entry" (ROE) forms and securing signatures from affected property owners on the ROE forms prior to conducting sanitary sewer cleaning.

B. The **Contractor** shall keep a daily log of the distribution of the door hangers. This shall be maintained and submitted to the **County** and/or Program Manager upon request.

C. The **Contractor** shall alert the appropriate **County** and Program Manager personnel of their work locations on a daily basis.

D. **Contractor** will provide and place "Right-of-Way" signs in prominent locations where cleaning is planned 24-hours in advance of commencing the inspection. Signs will be a minimum of 24 inches wide by 18 inches high with letters a minimum of 2 inches high. Signs will be supported a minimum of 12 inches above grade by integral metal frames. Wording on the signs shall be similar to the following:

SANITARY SEWER CLEANING WILL BE CONDUCTED ON "date" and "time." Contact "person" with "company" at "phone number" for additional information.

3.05 DOCUMENTATION

A. The **Contractor** shall keep records (in a log-type Access Database form) of the work accomplished in the cleaning of the pipes. With each pay request, digital backup documentation is required. The following information shall be required as a minimum:

1. Location (street address) and type of surface cover
2. Upstream Manhole ID Number to Downstream Manhole ID Number
3. Pipe ID Number
4. Date and Time
5. Length of Pipe
6. Condition and depth of manholes
7. Size and type of main

8. Type and condition of manhole

9. Type of cleaning performed and various types of equipment used.

10. Meter readings (fire hydrant use)

11. Remarks as to type of materials removed, amount of materials removed, and number of hours spent on each pipe section

B. The **Contractor** shall complete work on each asset as assigned via the Program Manager. Upon start of work, the **Contractor** shall receive work orders/assignments as assigned by the Project Manager. The **Contractor** shall maintain and synchronize the status of each work order/assignment issued.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

1.01 GENERAL

A. Description

Concrete reinforcement shall include, but not necessarily be limited to, furnishing and placing various types and/or sizes of steel reinforcing for embedment in Portland cement concrete as specified in the Contract Documents.

B. Related Work Included Elsewhere

Not applicable.

C. Quality Assurance

1. Inspection and Testing

The Engineer will inspect all materials before and/or after installation to ensure compliance with the Contract Documents. When specific tests of materials are called for in the referenced standards and specifications, the Engineer has the option of requiring that any or all of these tests be performed for materials furnished for a specific project. When testing is required, it will be specified herein or in the “Special Provisions”.

2. Tolerances

Reinforcing bars shall be cut and bent within the following tolerances:

a. Sheared Length: Plus or minus 1 inch for #3 to #11 bars inclusive and 2 inches + for #14 and #18 bars.

b. Depth of Truss Bars: Plus 0, minus 1/2 inch.

c. Stirrups, Ties, and Spirals: Plus or minus 1/2 inch.

d. All Other Bends: Plus or minus 1 inch.

e. Tolerances in placement shall conform to Paragraph 7, Section 7 of the Manual of Standard Practice of the Concrete Reinforcing Steel Institute.

D. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for

all reinforcing bars and shall contain the following data, lists, and information; bar lists, placement plans, and bending diagrams: description, details, dimensions, and locations of each item; details in accordance with requirements of ACI 318.

2. Certificates of Compliance

Certificates of compliance shall be submitted in accordance with the "General Provisions" for all concrete reinforcement stating that the material furnished meets the requirements specified in Section 03200.02.

3. Certified Test Results

a. Certified test results shall be submitted for all epoxy coatings for deformed steel reinforcing bars showing that they meet the requirements specified in Section 03200.02.

b. A certified copy of mill tests shall be submitted on each heat of reinforcing steel delivered, showing physical and chemical analysis.

2.01 MATERIALS

A. Materials Furnished by the County

The **County** will not furnish any materials for concrete reinforcement.

B. Contractor's Options

Substitution of smaller size bars will be permitted only upon specific authorization by the Engineer. Substituted bars shall provide a steel area equal to or larger than that called for by the design provided the spacing is not reduced to a point where the clear distance between the bars is less than one and one-half times the nominal diameter of the bars, nor one and one-half times the maximum size of the course aggregate, nor 1 1/2 inches, and further provided that the planned cover is maintained. No additional compensation will be allowed because of the substitution of larger areas of steel.

C. Detailed Material Requirements

1. General

Reinforcing steel shall conform to the requirements of ACI 318.

2. Bar Reinforcement

Bar reinforcement shall consist of deformed bars meeting the requirements of AASHTO M 31, Grade 60. Grade 40 may be used for #5 and smaller bars where indicated on the Plans.

3. Tie or Dowel Bars

Tie or dowel bars shall be round steel bars meeting the requirements of AASHTO M 31, Grade 40 or ASTM A 36.

Sleeve for dowel bars shall be of sheet metal capable of sliding over 2 ± 1/4 inch of the dowel and shall have a closed end with a stop to hold the end of the sleeve at a minimum distance of 1 inch from the end of the dowel bar.

4. Welded Steel Wire Fabric

Welded steel wire fabric shall meet the requirements of AASHTO M 55. Fabric used in pavement construction shall be furnished in flat sheets. When galvanizing is specified, the fabric shall be galvanized after fabrication.

5. Welded Deformed Steel Wire Fabric

Welded deformed steel wire fabric shall meet the requirements of AASHTO M 221.

6. Fabricated Steel Bar Mats

Fabricated steel bar mats shall consist of steel meeting the requirements of AASHTO M 31 fabricated to meet the requirements of AASHTO M 54.

7. Wire Fabric for Pneumatically Applied Mortar

Wire fabric for pneumatically applied mortar and concrete encasement shall meet the requirements of AASHTO M 55. It shall be fabricated from size W1.4 wire on 3-inch centers in each direction. It shall have a minimum galvanized coating of 0.8 ounces per square foot when tested in accordance with AASHTO T 65.

8. Cold Drawn Steel Wire

Cold drawn steel wire for concrete reinforcement shall meet the requirements of AASHTO M 32.

9. Tie Devices

Tie devices for use in securing contiguous traffic lanes of Portland cement concrete pavement or a traffic lane and concrete curb or combination curb and gutter shall be of malleable iron or steel. The tie devices shall meet the dimensions specified and produce a frictional force of at least 160 pounds per foot of spacing when tested in accordance with MSMT 512.

10. Galvanizing

Galvanizing for deformed steel bars shall be in accordance with ASTM A 153.

11. Epoxy Coatings for Deformed Steel Reinforcing Bars

Epoxy coatings for deformed steel reinforcing bars shall be epoxy powders which are electrostatically spray applied to sandblasted near white steel (fusion bonded epoxy resin). Ties, supports, and inserts used in conjunction with epoxy coated steel reinforcing bars shall be similarly coated.

a. Prequalification

Prequalification of epoxy coating will be based on MSMT 613 with the following limits:

Property	Requirement
Thickness, mils	5 to 11 after curing
Holidays/foot	2 max.
Bend Test	No cracks in coating
Hardness, KHN	16 min.
Pullout Strength Ratio Coated/Uncoated	0.80 min.
Impact Resistance, Area of Damage Square Inches	0.15 max.
Abrasion Resistance, mg loss	100 mg/1000 cycles max.
Chemical Resistance	The coating shall not blister, soften, disbond or develop holidays.
Chloride Penetration	1×10^{-4} Molar max.
Resistance to Applied Voltage	No evolution of hydrogen gas at the cathode or rusting at the anode within one hour. No holidays developed at the end of 30 days of testing.

b. Control and Acceptance

Control and acceptance of epoxy coating will be based on MSMT 613 with the following limits:

Property	Requirement
Thickness, mils	5 to 11 after curing
Holidays/foot	2 max.
Bend Test (No. 5 Deformed Steel Reinforcing Bars)	No cracks in coating
Hardness, KHN	16 min.

NOTE: Condition of cure shall be checked by the applicator's method deemed most effective to determine that the coating is fully cured.

c. Patching Materials

Patching or repair material shall be available through the epoxy powder manufacturer. The material shall be compatible with epoxy coating and inert in concrete. The material shall be capable of allowing concrete to be placed within 1 hour after application at an ambient temperature of 35°F.

3.01 EXECUTION

A. Fabrication

1. General

After bar lists and bending diagrams have been approved, fabricate each unit of reinforcement to the type, shape, size, grade, and dimensions shown on the approved shop drawings.

2. Cutting and Bending

Perform cutting and bending of reinforcing bars before shipment to the site. Bend all bars cold in a manner that will not injure the material and in accordance with the Manual of Standard Practice of the Concrete Reinforcing Steel Institute.

B. Shipping, Handling, and Protection of Material

Reinforcing steel bars shall be shipped in standard bundles and tagged and marked in accordance with the provisions of the Code of Standard Practice of the Concrete Reinforcing Steel Institute. Bundles shall be kept intact and material undamaged and properly identified until ready for use.

Reinforcing steel bars shall be stored on blocking, racks, or platforms so as not to be in contact with the ground.

Bars shall be kept free from dirt, paint, oil, grease, loose or thick rust, detrimental mill scale, or other foreign substances. However, when steel has on its surface detrimental rust, mill scale, dust, or dirt, it shall be cleaned by a method approved by the Engineer.

C. Placing and Fastening

The placing of bars shall conform to the recommended practices in "Placing Reinforcing Bars" as published by the Concrete Reinforcing Steel Institute.

Reinforcing steel shall be accurately placed in the position shown on the plans and firmly held during the depositing and setting of the concrete. Cover, or the distance between the external face of the bar and the face of the finished concrete, shall be as indicated on the Plans. Reinforcing steel bars embedded in concrete shall not be bent after they are in place. Bars shall be tied at all intersections with 16 1/2 gage black annealed wire except that where spacing is less than 1 foot each direction alternate intersections need not be tied. All intersections shall be tied in the top mat of reinforcement placed on the top slabs of box culverts. Abrupt bends shall be avoided except where one steel bar is bent around the other. Stirrups and ties shall always pass around the outside of main bars and be securely attached thereto. All reinforcing steel shall be securely held at the proper distance from the forms by means of plastic coated steel chairs. Blocks for holding reinforcement away from contact with earth shall be precast concrete blocks of approved shape, mix, and dimensions and shall have tie wires embedded in them. Layers of bars shall be separated by approved plastic coated metal chairs or bolsters.

Any broken or damaged concrete spacer blocks shall be removed before concrete is placed. The use of pebbles, pieces of broken stone or brick, metal pipe, or wooden blocks as spacers will not be permitted. Reinforcing steel when placed in the work shall be free from flake rust, dirt, and foreign material before any concrete is placed. Any mortar which may be adhering to the reinforcing steel shall be removed. No concrete shall be deposited until the Engineer has inspected the placing of the reinforcing steel and given permission to place the concrete. The **Contractor** shall allow the Engineer 4 hours of normal working time after the reinforcement and forms are in place to conduct the inspection. Any bars of incorrect size, length, or shape shall be removed and replaced with correct bars. Any bars located or spaced incorrectly shall be relocated or spaced correctly before permission is given to place concrete, and such replacements and corrections shall be at the **Contractor's** expense. All concrete placed in violation of these provisions shall be rejected and removed.

When the ambient air temperature is below 40°F, the temperature of the air in contact with

the reinforcement shall be raised to 40°F prior to placing concrete. When the ambient air temperature is above 70°F and the reinforcement is exposed to the direct rays of the sun, the reinforcement shall be cooled by means of a water spray or by shading prior to placing concrete.

D. Splicing

Reinforcement shall be furnished in full lengths as indicated on the Plans. Splicing, except where shown on the Plans, will not be permitted without written approval from the Engineer; and if additional splices are used, the additional weight occasioned by such splices shall be at the **Contractor's** expense.

All splices shall conform to Class "C" in ACI 318 or as shown on the Plans. Splices shall be well distributed where conditions permit. Except where otherwise shown on the Plans, lap splices shall be made with the bars placed in contact and wired together. Lapped splices for reinforcement shall not be used for bar sizes larger than No. 11.

No welding of reinforcing steel or attachments thereto will be permitted without written authorization by the Engineer, unless so indicated on the Plans. Welding, if permitted, shall be in accordance with AWS D1.4.

3.02 METHOD OF MEASUREMENT

Measurement for concrete reinforcement consisting of plain round bars, deformed bars, or wire mesh will not be made, but shall be included in the unit or lump sum price bid for other items

3.03 BASIS OF PAYMENT

A. General

1. Payment for concrete reinforcement consisting of plain round bars, deformed bars, or wire mesh will not be made as such, but the cost thereof shall be included in the unit or lump sum price bid for other items unless the Proposal indicates that payment is applicable.

+++ END OF SECTION 03200 +++

SECTION 03300
CAST-IN-PLACE CONCRETE STRUCTURES

1.01 GENERAL

A. Description

Cast-in-place concrete structures shall include the construction of Portland cement concrete structures to the lines and dimensions and at the locations shown on the Plans and in accordance with the Contract Documents.

Related Work Included Elsewhere

1. General excavation; Section 02220.

2. Excavation support; Section 02400.

3. Dewatering; Section 02512.

B. Quality Assurance

1. General

a. The Engineer will inspect all materials before and/or after installation to insure compliance with the Contract Documents. When specific tests of materials are called for in the referenced standards and specifications, the Engineer has the option of requiring that any or all of these tests be performed for materials furnished for a specific Project. When testing is required, it will be specified herein or in the “Special Provisions”.

b. The Engineer will conduct normal concrete job control tests, i.e. slump and air content, on the plastic concrete and will prepare test cylinders in accordance with Section 03310.

c. For the purpose of determining the time when falsework, forms, etc. may be removed, backfill made, and when loads may be applied to structures, an adequate number of test specimens shall be made in addition to the number required to check the quality of the concrete being produced.

2. Inspection

The **Contractor** shall provide all facilities as are reasonably required for the safe and convenient conduct of the Engineer's inspection procedures.

3. Tolerances for Formed Surfaces

Formed surfaces shall be true to the lines and dimensions shown on the Contract Documents to the tolerances listed herein:

a. Variation from plumb:

1) In the lines and surfaces of columns, piers, walls, and in

arrises: In any 10 foot of length	1/4 inch
Maximum for the entire length	1 inch

2) For exposed corner columns, control-joint grooves, and other conspicuous lines:

In any 20-foot length	1/4 inch
Maximum for the entire length	1/2 inch

b. Variation from the level or from the grades specified in the Contract Documents:

1) In slab soffits, ceiling, beam soffits, and in arrises, measured before removal of supporting shores:

In any 10 foot of length	1/4 inch
In any bay or in any 20 foot length	3/8 inch
Maximum for the entire length	3/4 inch

2) In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:

In any bay or 20 foot length	1/4 inch
Maximum for the entire length	1/2 inch

c. Variation of the linear structure lines from established position in plan and related position of columns, walls, and partitions:

In any bay	1/2 inch
In any 20 foot of length	1/2 inch
Maximum for the entire length	1 inch

d. Variation in the sizes and location of sleeves, floor openings, and wall openings: ±1/4 inch

e. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls:

Minus	1/4 inch
Plus	1/2 inch

f. Footings*

1) Variations in dimensions in plan:

Minus	1/2 inch
Plus	2 inches

2) Misplacement or eccentricity:

2% of the footing width in the direction of misplacement but not more than	2 inches

3) Thickness:

Decrease in specified thickness	5%
Increase in specified thickness	No limit

g. Variation in steps:

1) In a flight of stairs:

Rise	±1/8 inch
Tread	±1/4 inch

2) In consecutive steps:

Rise	±1/16 inch
Tread	±1/8 inch

*Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items.

4. Defective Work

Porous areas, open or porous construction joints, and honeycombed concrete indicate that all of the requirements for mixing, placing, and handling have not been complied with and shall be considered as sufficient cause for rejection of the members of the structure thus affected. Defective work exposed upon removal of forms shall be entirely removed or repaired within 48 hours after forms have been removed.

No repaired area will be accepted unless:

a. the structural requirements have not been impaired by reducing the net section of compression members;

b. the bond between the steel and concrete has not been reduced;

c. the areas shall be finished so as to blend in every respect with the texture, contour and color of the surrounding concrete.

If the above limitations cannot be satisfied, the members or unit involved shall be removed and satisfactorily replaced entirely at the **Contractor's** expense.

Defective areas shall be cut out to such depth that all voids, honeycombed, or any other defect are entirely removed. The edges of the material remaining in place shall be cut perpendicular to the finished surface to the full depth of the material removed but not less than 1 inch.

If the removal of defective concrete affects the structural requirements as above defined, the member likewise shall be removed and replaced.

The area to be repaired and a space at least 6 inches wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar. The patch shall be made with mortar; the mix of which shall be predetermined by making trial batches to secure a mix matching the color and texture of surrounding concrete. In order to facilitate color matching, the **Contractor** shall obtain a quantity of Portland cement from his concrete supplier that shall be used to mix the patching mortar. The amount of water used in mixing the mortar shall be as little as is consistent with the requirement of handling and placing. The mortar shall then be put aside for 1 hour during which time it shall be mixed with a trowel to prevent setting. No additional water shall be added to the mix. The mortar shall be thoroughly compacted in place and screeded off so as to leave the patch slightly higher than the surrounding surface. It shall then be left undisturbed for a period of 1 to 2 hours to permit initial shrinkage before being finally finished. The patch shall be finished in such a manner as to match the adjoining surface. On surfaces where unlined forms have been used, the final finish shall be obtained with straightedge spanning the patch and held parallel to the direction of the form marks. After the patches have set sufficiently so that the surface will not be damaged, curing and protection of concrete shall proceed as required for the original concrete section.

C. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for the following materials, and shall include the following information: preformed expansion joint material, joint sealers, curing materials, form release compounds, and waterstops: general product information, chemical composition, and dimensional information where appropriate.

2. Certificate of Compliance

Certificates of compliance shall be submitted in accordance with the "General Provisions" for all waterstop, joint filler, preformed joint fillers, form release compounds, paraffin wax, and Portland cement concrete curing materials stating that the material furnished is in accordance with, and meets the test requirements specified in Section 03300.02.

2.01 MATERIALS

A. Materials Furnished by the **County**

1. The **County** will not furnish any materials for cast-in-place concrete.

2. The **Contractor** may purchase water from the **County's** potable water system in accordance with current **County** policies and procedures. The **Contractor** shall contact the Bureau of Utilities, Meter Section, for requirements.

B. **Contractor's** Options

The **Contractor** may furnish higher strength concrete than specified.

C. Detailed Material Requirements

1. Portland Cement Concrete

Portland cement concrete shall be the mix number called for in the Contract Documents and shall be in accordance with the requirements of Section 03310.

2. Concrete Reinforcement

Concrete reinforcement shall be the size and type specified and shall be in accordance with the requirements of Section 03200.

3. Joint Fillers

The hot applied material shall be in accordance with AASHTO M 173. Manufacturers' recommendations regarding pouring temperature will be used when testing this material. If a range of temperatures is recommended, the mid-point will be used as the pour point. The cold applied type shall be in accordance with AASHTO D 1850.

4. Preformed Joint Fillers

The cork type shall meet the requirements of AASHTO M 153. The bituminous fiber type shall be in accordance with AASHTO M 213 with the bitumen content determined by MSMT 408.

5. Roofing Paper

Roofing paper to be used in expansion joints shall be composed of roofing felt saturated and coated on both sides with an asphaltic material. It shall not weigh less than 39.8 pounds per 100 square feet and shall not crack when bent 90 degrees over a 1/2 inch radius at room temperature.

6. Waterstops

Waterstops shall be made of rubber or polyvinyl chloride. The rubber type may be of natural rubber, synthetic rubber, or a suitable combination of natural and suitable synthetic rubber. The polyvinyl chloride shall contain at least 90% virgin polyvinyl chloride. The remaining 10% may include one or more monomers copolymerized with vinyl chloride or consist of other resins mechanically blended with polyvinyl.

The waterstop shall be of the shape and dimensions shown on the Plans. The cross section shall be uniform along the length and transversely symmetrical so that the thickness at any given distance from either edge of the waterstop shall be uniform. The waterstop shall be dense, homogeneous, and free from holes and other imperfections.

The waterstop shall meet the following requirements:

Tensile Strength, ASTM D 412, psi min.	2000
Elongation at Break, ASTM D 412, % min.	300
Hardness, Rubber, Type A Durometer, ASTM D 2240	55 ± 5
Hardness, PVC, Type A Durometer, ASTM D 2240	75 ± 5

7. Form Release Compounds

Form release compounds shall effectively prevent the bonding of the concrete to the forms. The form release compounds shall not cause discoloration of the concrete nor adversely affect the quality or rate of hardening at the interface of the forms. The compounds will be tested in accordance with MSMT 503.

The flash point of the material shall not be less than 100°F when tested in accordance with AASHTO T 73.

8. Paraffin Wax

Paraffin wax for use as a bond breaker for concrete shall be water clear. The flash point shall not be less than 380°F when tested in accordance with ASTM D 92.

9. Portland Cement Concrete Curing Materials

Curing materials shall be burlap cloth, sheet materials, or liquid membrane-forming compounds.

a. Burlap

Burlap cloth shall be made from jute or kenaf and shall be in accordance with AASHTO M 182, Class 1, 2, or 3.

b. Burlap Polyethylene Sheeting

Sheet material shall be in accordance with AASHTO M 171 except that tensile strength and elongation requirements are waived. White burlap polyethylene sheeting shall give a finished product weight of not less than 10 ounces per square yard.

c. Liquid Membrane

Liquid membrane-forming compounds shall be in accordance with AASHTO M 148.

Field control testing of the white pigmented curing compounds will be on the basis of weight per gallon. The samples shall not deviate more than plus or minus 0.3 pounds per gallon from the original source sample.

10. Vapor barrier

a. Building paper shall be Sisal-Kraft building paper, conforming to requirements of FSS UUB 790A.

b. Polyethylene sheeting shall be 0.006-inch thick, conforming to requirements of ASTM D 2103.

3.01 EXECUTION

A. General

1. Concrete shall be mixed as specified in Section 03310. Concrete shall be delivered to the site in accordance with ASTM C 94.

2. The **Contractor** will be required to use concrete equipment of sufficient capacity to complete any unit or section of masonry between construction joints, as indicated on Plans, in one continuous operation consistent with placement operations as approved by the Engineer.

3. Hand mixing may be permitted with written approval of the Engineer for small volumes of concrete. However, its intended use is for small isolated areas where structural integrity is not critical.

4. Before placing any concrete, the **Contractor** shall install all sleeves, anchors, frames, fittings, pipes, conduits, or other special devices called for in the Contract Documents. No concrete shall be placed until this work has been approved by the Engineer. The **Contractor** shall ascertain that all material to be installed in the concrete by other trades has been placed prior to pouring any concrete. Any concrete poured without prior provisions having been made for inclusion of the indicated inserts and materials will be subject to rejection by the Engineer and/or correction at the **Contractor's** expense.

B. Forms

Forms for concrete work shall be mortar tight.

1. Design Criteria

Design of the forms shall be the **Contractor's** responsibility. Forms shall be designed for strength and deflection to resist all loads and pressure of wet concrete. The design shall provide for rate of pour, effect of vibration, and use of retarders, etc. In addition, horizontal surfaces shall have applied to them a live load of 50 pounds per square foot. This load is to be used in the design of the forms for strength only and is not to be used in computing deflections. However, in the design of forms for horizontal slabs, in no case shall this loading be less than a total of 120 pounds per square foot. (This does not apply to form joists, form wales, etc.) No form member or support thereof shall have a deflection in excess of 1/240 of its span length, and in no case shall said deflection exceed 1/4 inch. An exception is deflection of form surfaces for concrete floor slabs where such concrete is supported by beams, stringers, or girders, which may be 1/180 of the span length but not in excess of 1/2 inch. In steel forms that remain in place, camber shall not be used to compensate for deflection in excess of the foregoing limits. The design spans of the form sheets shall be the clear span of the form plus 2 inches measured parallel to the form flutes.

2. Concrete and Form Unit Weights

All buckets, buggies, finishing machines, etc. shall be removed from the forms before concrete attains its initial set. The concrete shall be assumed to weight 150 pounds per cubic foot unless lightweight concrete is specified. The lumber in the forms shall be assumed to weigh 60 pounds per cubic foot. When forms are composed of material other than lumber, the unit weight shall be in accordance with the AASHTO specifications.

3. Plywood Forms

The strength of plywood (without backing) shall be calculated on the basis of the grain of the face plies running parallel to its span, and it shall be so installed. When the plywood is against backing, the strength of the plywood will be neglected; and the backing must carry the entire load. In cases where the plywood form panels are to be reused, the actual span length of the plywood shall be 2 inches less than the computed maximum allowable span. The unit stresses to be used shall be as subsequently described.

4. Forms at Construction Joints and Corners

At construction joints in concrete, ties or bolts shall be provided 3 to 6 inches from each side of the joint for tightening the forms against the hardened concrete (first pour) immediately prior to placing fresh concrete. At joints where forms have been removed and reconstructed, the form surface shall extend over the concrete already in place; and the forms shall be drawn tightly against the previously placed concrete

immediately prior to placing the fresh concrete. Where forms have been extended, the forms shall be retightened against the concrete already in place immediately before placing fresh concrete.

Forms shall be filleted at all sharp corners, except when otherwise indicated on the Plans and shall be given a bevel or draft in the case of all projections, such as girders, copings, etc., sufficient to insure easy removal.

5. Bracing and Maintenance

Special attention shall be paid to bracing; and where the forms appear to be insufficiently braced or unsatisfactorily built, either before or during the placing of concrete, the Engineer will order work stopped until the defects have been corrected. All forms shall be so maintained as to eliminate the formation of joints due to the shrinkage of lumber. All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. For narrow walls where access to the bottom of the forms is not readily attainable otherwise, provide temporary openings at the base of column forms, wall forms, and at such other locations as may be necessary to clean out all chips, dirt, sawdust, or other extraneous material immediately prior to placing concrete. Existing forms may be extended after the concrete in said forms have been in place for at least 12 hours, provided such form extension can be done without any damage to the previously placed concrete.

Unit stresses for forms, form supports, falsework, and bracing shall not exceed the AASHTO Specification except as modified hereafter:

a. Bending in Timber - Unit stresses stipulated in AASHTO for timber may be increased by 1/3 with a maximum value of 1800 psi.

b. Horizontal Shear (Timber) - Horizontal shear for beams up to 6 inches in depth shall not exceed 200 psi. Form beams more than 6 inches in depth, the horizontal shear shall not exceed 150 psi. The method for calculating horizontal shear shall be in accordance with AASHTO specifications.

c. Compression Perpendicular to Grain (Timber) - Unit stresses stipulated in the latest edition of the AASHTO specifications for treated timber may be increased by 25%.

d. Compression Parallel to Grain (Timber) - Unit stresses stipulated in the latest edition of the AASHTO specifications for treated timber may be increased by 25%.

e. Timber Columns - Use values from formulas in AASHTO specifications increased by 25% except for long columns when no increase in value will be allowed.

f. Moduli of Elasticity - Same as stipulated in AASHTO specifications.

g. Structural Steel Members - The unit stresses developed in structural steel members of formwork or falsework shall not exceed the values stipulated in the AASHTO specifications for the appropriate steel grade, except that the axial allowable tension in the net section may be increased to 24,000 psi maximum, and tension in bolts at root of thread may be increased to 16,000 psi maximum (provided deflections are satisfactory). The 24,000 psi does not apply to the tension flange in beams.

h. Steel Forms which Remain in Place - The unit working stress in the steel sheet and supporting members shall be not more than 0.725 of the specified minimum yield strength of the material furnished but shall not exceed 36,000 psi. Physical design properties shall be computed in accordance with requirements of the latest published edition of the American Iron and Steel Institute Specification for the Design of Cold Formed Steel Structural Members. The deflection limitations specified in Paragraph of this Article shall also apply to structural steel members.

6. Forms Scaffolds and Platforms

Form scaffolds or working platforms shall be designed and constructed as an integral part of the form supports. Details of these scaffolds or platforms shall be shown on Shop Drawings for forms submitted for review and acceptance. Separate design calculations shall be furnished with the Shop Drawing submission.

Design shall meet the minimum requirements for component parts as determined under Construction Safety and Health Standards for all projects, except that guardrail height shall be approximately 42 inches high and supports for the scaffolds or working platforms shall be designed to support all dead leads and an applied live load of 75 pounds per square foot of horizontal surface.

7. Form Supports

In addition to all other loads, the design of the form supports, etc., if they are to be used to support the concrete finishing equipment, must also recognize these additional loadings.

8. Forms for Unexposed Surfaces

Forms for unexposed surfaces (such as concrete surfaces in contact with earth) may be composed of sheathing lumber not over 8 inches wide and surfaced four sides to a uniform thickness of at least the minimum dimension approved on the form plans. All sheathing studs and bracing shall be of sound lumber, free from defects and loose knots. Studs and wales shall be straight and true and surfaced on two edges to uniform width. The inside face of the forms shall be of sufficiently smooth construction that the resulting concrete surfaces will be accurately formed and coincident with the required dimensions.

9. Forms for Exposed Surfaces

Forms for surfaces of concrete work exposed to weather or view (such as walls, retaining walls, inside surfaces of culvert barrels, etc.) shall be either lined or unlined forms as described in the following

10. Lined Forms for Exposed Surfaces

The contact surface of lined forms for surfaces exposed to weather or view shall be approved composition board or sanded plywood, especially manufactured for concrete formwork. All studs shall be surfaced two edges to a uniform width and shall be of a grade of lumber that is solid, straight and free from defects that might impair its strength. The backing for form lining shall be constructed of a good grade of form lumber that is solid, straight, and free from defects that might impair its strength but need not be of quality used for contact forms for unexposed surfaces. All sheathing for form backing shall be surfaced two sides to a uniform thickness of at least the minimum dimension approved on the form plans. Form sheathing shall be built solidly, securely nailed to studs and so spaced as to prevent any bulging of the lining.

All lining shall be used in pieces as wide as is practicable. Where horizontal rustication occurs, horizontal joints in the lining shall be made behind a rustication strip. Otherwise, horizontal joints in the lining shall be placed at the same respective elevations in all portions of the structure. Where vertical rustication occurs, vertical joints in lining shall be made behind a rustication strip. Otherwise, vertical joints must be kept to a minimum and shall be placed to make a uniform pattern. Joints in lining and backing shall not occur at the same place and abutting edges of adjacent sheets shall be nailed to the same board. All joints shall be butted tight together and sealed with an approved crack filler as the lining is nailed in place. The lining shall be nailed to the backing beginning at one end of a sheet and work uniformly across it to prevent buckling. Three penny blue shingle nails or similar nails with thin, flat heads shall be used to attach the lining material to the backing. The nails shall not be farther apart than 8 inches along the edges, and there shall be at least one nail for each square foot of surface.

11. Unlined Forms for Exposed Surfaces

Unlined forms in contact with surfaces exposed to weather or view shall be constructed of 5-ply, sanded plywood of approved thickness. Plywood shall be made with a waterproof glue and shall be especially manufactured for concrete formwork. All studs and wales shall be surfaced two edges to a uniform width.

Full size sheets of plywood shall be used except where smaller pieces will cover an entire area. All horizontal and vertical joints shall be backed solidly to prevent leakage, and the edges of abutting sheets shall be nailed to the same stud or blocking with sixpenny box nails, not farther apart than 8 inches. Where rustication occurs, horizontal joints in the plywood shall be made behind the rustication strips. Where no rustication strips are used, joints shall be made at the same respective elevations in

all portions of the structure. Where vertical rustication occurs, vertical joints in lining shall be made behind a rustication strip. Otherwise, vertical joints must be kept to a minimum and shall be butted tight together and sealed with an approved crack filler as the plywood is nailed in place.

12. Removable Steel Forms

Removable steel forms shall meet all requirements of these Specifications for forms except as otherwise noted herein.

Forms for barrels of reinforced concrete box culverts shall be steel forms or forms having wood or composition wood panel sheathing set in metal frames. The minimum thickness of steel in forms for box culverts shall be 10 gage. Surfaces of box culvert and rigid frame wingwalls and headwalls exposed to view must be wood formed.

13. Release Agents

All forms shall be treated with a form release compound or saturated with water immediately before placing concrete. In case forms have been erected for some time and have become dry so that joints have opened, then the forms shall be thoroughly soaked until the joints are closed.

14. Form Removal

All forms for concrete work shall be removed and disposed of by the **Contractor** after formwork requirements have been complied with, except those that are designated to remain in place.

Forms for pipe endwalls may be removed after the concrete has been in place for a period of 24 hours unless it is necessary to protect the concrete against cold weather, in which case the forms shall remain in place for the entire protection period.

Forms for vertical surfaces shall remain in place for a period of 48 hours. If, however, forms are removed before the concrete is 7 days old, the vertical surfaces shall be immediately covered with curing material and the concrete kept wet and so covered until the concrete is 7 days old. Horizontal form, and falsework, carrying loads shall remain in place for a minimum of 7 days and until the concrete has attained a compressive strength of 3000 psi. Internal bulkheads used for forming construction joints, contraction joints, expansion joints, etc. may be removed after the concrete has been in place for 24 hours, if it is necessary to do so for the continuance of the work without interruption.

Method of form removal likely to cause overstressing of the concrete shall not be used. Forms and their support shall not be removed without the approval of the Engineer. Supports shall be removed in such a manner as to permit the concrete to uniformly and gradually take the stresses due to its own weight.

15. Reuse of Forms and Falsework Material

Plywood and lining material may be reused provided that the surfaces and edges are in a satisfactory condition and provided that they are cleaned off and sandpapered with the proper grade sandpapers and coated with form release compound.

Forms and falsework material reused shall be maintained at all times in good condition as to accuracy of shape, strength, rigidity, mortar tightness, and smoothness of surface. Any warped or bulged lumber or plywood will be rejected. Unsatisfactory form and falsework materials shall not be used and, if condemned, shall be removed immediately from the work.

16. Form Ties

Only non-removable form ties approved by the Engineer shall be used. Form ties for water or sewage containing structures shall have a washer attached in the center of the wall to act as a water seal. Ties shall be adjustable in length and of such type as to leave no metal closer than 2 inches from the surface. They shall not be fitted with any lugs, cones, washers, or other device to act as a spreader within the form, or for any other purpose that will leave a hole larger than 7/8 inch in diameter or a depression back of the exposed surface of the concrete. If approved by the Engineer, flat ties with 2 inch break back and rubber or plastic elongated cones may be used in removable steel forms for barrels of box culverts. Elongated rubber or plastic cones shall not be used as spreaders within the form.

Tie rod clamps shall remain in place until forms are to be removed as specified elsewhere and until the concrete has hardened sufficiently to permit the tie rods to be removed without damaging the concrete. Care shall be exercised to avoid spalling the concrete on the exposed surface. Cutting ties back from the face of the wall will not be permitted. All voids left in the concrete after the exposed form ties are removed shall be completely filled with non-shrink mortar and the surface finished as specified.

17. Form Support Brackets or Devices

Steel brackets or other devices attached to previously poured concrete for supporting forms may be used provided all parts are satisfactory to the Engineer for size, strength, and material. No metal of an insert, threader, or anchor, etc. that remains in place in the concrete shall be within 2 inches of the surface. The concrete supporting the brackets or other devices shall be cured and shall have attained a minimum compressive strength of 3000 psi before the brackets or other devices are attached. All voids left in the concrete after brackets or other devices are removed shall not be greater than 2 inches in diameter and shall be completely filled with non-shrink mortar and the surface finished as specified.

C. Concreting

Before placing concrete, all sawdust, chips, and other construction debris and extraneous matter shall be removed from interior of forms. No struts, stays, and braces, serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their locations, will be permitted.

All concrete shall be placed in the dry, unless Plans and/or "Special Provisions" require the placement of tremie concrete.

1. Footings

Spread footing faces shall be placed against plumb, undisturbed material or forms unless shown otherwise on the Plans. If faces of completed and/or proposed excavated footing areas are disturbed during the excavation activities in the area, the footings will be extended to bear on undisturbed faces, at the **Contractor's** expense.

2. Piles

All material forced upward by the driving of the piling shall be removed prior to placing the concrete. This removal will not be a pay item and shall be done by hand labor unless the pile spacing or use of special equipment will permit this removal without damaging the placed piling. This requirement will be waived in the case of tremie seals if the minimum thickness of footing concrete, pile embedment, and the required sealing capacity of the tremie concrete can be maintained. Any special requirements other than those contained in these Specifications for the tremie type of design will be shown on the Plans.

3. Temperature Controls

Concrete shall not be placed when the air temperature in the shade and away from artificial heat is below 40° or 50°F and falling without the written permission of the Engineer. Concrete shall at no time be mixed at a temperature of less than 50°F nor more than 90°F. If the temperature is below 50°F then one or more of the following methods shall be used to obtain the required temperature all as approved by the Engineer.

a. When the method of heated mixing water is used, the water shall not be above 170°F when introduced into the mix.

b. When the method of heated aggregates is used, aggregates containing frozen lumps shall be independently heated; and no materials containing frozen lumps, ice, or snow shall be allowed to enter the mixer. Aggregates may be heated by steam coils or other dry heat but not by discharging live steam or hot water into them. Heating by means of a flamethrower or any direct flame will not be permitted.

When the ambient air temperature is below 40°F, the temperature of the air in contact with the reinforcement shall be raised to 40°F prior to placing concrete. When the ambient air temperature is above 90°F and the reinforcement is exposed to the direct rays of the sun, the reinforcement shall be cooled by means of water spray prior to placing concrete.

When abnormal wind and/or storms are forecast locally by the U.S. Weather Bureau, concrete shall not be placed during the period covered by the forecast.

4. Foundation Design

As previously stated, foundations of structures are subject to Engineer's approval before pouring concrete. The **Contractor** shall be solely responsible for any reinforcing steel fabricated prior to approval of foundations. If bearing material varies from that assumed in design, footings may be lowered, raised, deepened, subfoundations placed or piles used, or a combination of these methods used to best obtain bearing. If planned footings are changed vertically, reinforcing steel shall be revised as required. Selected backfill will be allowed as subfoundation for box culvert barrels, headwalls, and miscellaneous structures. If Mix No. 1 concrete is used, it need not be vibrated, shall be unreinforced, and the usual curing and cold weather requirements will be reduced to 3 days.

Concrete shall be placed so as to avoid segregation of the material and the displacement of the reinforcement. The use of troughs or chutes, for conveying concrete more than 15 feet from the mixer to the forms will not be permitted. Belt conveyors or concrete pumps shall be used where there is more than 15 feet to point of discharge.

Open troughs and chutes shall be of metal or metal lined. Where steep slopes are required, the chutes shall be equipped with baffles or be in short length that reverses the direction of movement.

All chutes, troughs, and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run. Water used for flushing shall be discharged clear of the structure and such that it does not enter an existing water course. Chutes, troughs, pipes, etc. in contact with concrete shall not be aluminum.

Where placing operations would involve dropping the concrete more than 5 feet, the concrete shall be deposited through sheet metal, canvas, or other approved tube. The use of aluminum hoppers or tubes will not be permitted. The lower ends shall be kept as close as possible to the newly placed concrete and not more than 3 feet above it. All tubes, metal, canvas, or other shall have a minimum diameter of 8 inches unless otherwise approved by the Engineer. An exception to this placing requirement is permitted for the filling with concrete of cast-in-place piles. In this case, tubes or chutes are not required unless specifically called for by the Contract Documents. The shells or casings shall be filled from a hopper with spout applied directly to the top of the pile shell.

After initial set of the concrete, the forms shall not be jarred; and no strain shall be placed on the ends of the reinforcing bars that project outside the face of concrete.

Concrete, during and immediately after depositing, shall be thoroughly compacted. The compaction shall be done by mechanical vibration complying with requirements stated elsewhere in this section.

Concrete shall be placed in horizontal layers not more than 12 inches deep except as hereinafter provided. When less than the complete area of a layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and compacted before the preceding layer has taken initial set to prevent injury to the green concrete and avoid separation or joints between the layers. Each layer shall be compacted so as to avoid the formation of a cold joint with a preceding layer that has not taken initial set.

When the placing of concrete is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete.

Immediately following the discontinuance of placing concrete, all accumulations of mortar splashed upon the reinforcing steel and the surfaces of forms shall be removed. Dried mortar chips and dust shall not be puddled into the unset concrete. If the accumulations are not removed prior to the concrete becoming set, care shall be exercised not to injure or break the concrete-steel-bond at and near the surface of the concrete while cleaning the reinforcing steel.

5. Rate of Concreting

Concrete in beams and girders shall be deposited uniformly for the full length of the beam or girder and brought up evenly in horizontal layers. Each of which shall not be over 3 feet high.

Concrete in slab spans shall be placed in one continuous operation and in one layer for each span, unless otherwise provided.

Concrete shall not be mounded on concrete slab forms but in placing shall be distributed over an area to a depth not exceeding the depth of the planned slab thickness plus 6 inches before spreading, compacting, finishing, etc.

Concrete in columns, walls, etc. shall be placed in one continuous operation, unless otherwise directed. The concrete shall be allowed to set at least 12 hours before any concrete is placed above them.

Where walls, piers, columns, struts, posts, etc. allow horizontal construction joints, succeeding lifts shall not be poured until the lower pour has been allowed to set for 12 hours.

6. Pneumatic Placing

Pneumatic placing of concrete will be permitted only if specified in the "Special Provisions" or if authorized by the Engineer in writing. The equipment shall be so arranged that no vibrations result that might damage freshly placed concrete.

Where concrete is conveyed and placed by pneumatic means, the equipment shall be suitable in kind and adequate in capacity for the work. The machine shall be located as close as practicable to the place of deposit. The position of the discharge end of the line shall not be more than 10 feet from the point of deposit. The discharge lines shall be horizontal or inclined upwards from the machine. No parts of the equipment in contact with the concrete mix or the discharge line are to be made of aluminum.

At the conclusion of placement, the entire equipment shall be thoroughly cleaned.

7. Pumping

Placement of concrete by pumping will be permitted only if specified in the "Special Provisions" or if authorized by the Engineer in writing. The equipment shall be so arranged that no vibrations result which might damage freshly placed concrete.

Where concrete is conveyed and placed by mechanically applied pressure, the equipment shall be suitable in kind and adequate in capacity for the work. The operation of the pump shall be such that a continuous stream of concrete without air pockets is produced. When pumping is completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients. No parts of pump or the discharge line are to be made of aluminum.

At the conclusion of placement, the entire equipment shall be thoroughly cleaned.

8. Use of Conveyors

Concrete may be moved from the mixer to its final position by use of conveyors. Conveyors shall be in sections, and concrete shall be deposited from one conveyor belt onto the next through a hopper. No individual section of the conveyor train shall rise more than 30 degrees from the horizontal. The belt travel speed shall not exceed 900 feet per minute for concrete slumps at 2 inches, and this speed shall be decreased for slumps exceeding 2 inches. Polyethylene or some other acceptable cover shall be placed under the conveyor line to contain any spillage from the belts.

9. Cofferdams

Where cofferdams are used, separate forms shall be constructed within the cofferdams except where footing concrete is to be placed against a base of undisturbed material and where the cofferdam is to remain in place and act as the concrete form. The water level in the space between the form and cofferdam shall be kept below the bottom elevation of all fresh concrete for 12 hours.

10. Concrete Exposed to Saline Water

When concrete is exposed to saline water, the water content shall be carefully controlled and so regulated as to produce concrete of maximum impermeability. In placing concrete, care shall be exercised to avoid the formation of stone pockets; and the concrete shall be thoroughly consolidated. After forms are removed, the concrete surface shall be left undisturbed.

The range of possible disintegration of the concrete from an elevation below that of extreme low tide to an elevation above that of extreme high tide will be determined by the Engineer; and except with his special permission, no construction joints will be located within this range. In the determination of this range, due consideration shall be given to wave action, ice formation and other conditions affecting the extreme limits of possible deterioration and disintegration.

Concrete which is to be in contact with saline water within the tide range and below said tide range shall in all cases be deposited in the dry. In no case shall saline water be allowed to come in direct contact with the concrete until it has been permitted to harden as required by the following table unless directed otherwise in writing by the Engineer.

Saline Content of Water by Weight in Parts per Thousand	Saline Water Shall Not Contact Concrete until Following Time in Days Has Elapsed after Initial Set
0 to 10	0
10 + to 15	7
15 + to 20	14
20 + to 25	21
over 25	30

Unless otherwise noted, such concrete shall be wet cured for at least seven days while being maintained at a temperature of 50°F or above.

11. Construction Joints

Construction joints shall be kept to a minimum and will be permitted only where shown on the Plans, or authorized by the Engineer in writing.

In order to bond successive courses, suitable keys shall be formed at the top of the lift where construction joints are permitted and at other levels where work is interrupted. These keys shall be as indicated on the Plans. At horizontal construction joints, the pour shall be allowed to set for about 12 hours before placing concrete above same.

After concrete has been placed and before it has hardened, all laitance and foreign material shall be removed from the surface. Before placing fresh concrete adjacent to hardened concrete, the surface of the hardened concrete shall be cleaned thoroughly of any remaining laitance or foreign material, scrubbed with wire brooms and clean water, and thoroughly drenched with water until saturated. It shall be kept saturated until the new concrete is placed.

Unless otherwise specified, the top surface of the concrete shall be leveled whenever a pour of concrete is stopped; and to insure a level, straight joint on exposed face, a strip of sheathing shall be attached to the form at the exposed face where the joint occurs. The concrete shall be carried not more than 1/2 inch above the underside of this strip. About 1 hour after concrete is placed, the strip shall be removed; and any irregularities in the joint line shall be leveled off with a wood float (use steel trowel at exposed face of joint). All laitance shall be removed. To avoid visible joints at chamfers, the top surface of the concrete shall be steel troweled adjacent to the chamfer using the top surface of the chamfer strip as a guide.

Where a feather edge might be produced at a construction joint, as in the sloped top surface of a wingwall, and inset form shall be used to produce a blocked-in addition to the proceeding layer which shall produce an edge thickness of concrete of not less than 6 inches in the succeeding layer.

12. Consolidation

All concrete shall be internally vibrated unless herein noted otherwise.

In addition of the internal vibration, certain specified vertical, inclined, or special faces which are exposed to weather or to view shall be externally vibrated when required by the Engineer.

Vibration shall be in accordance with the following requirements:

a. All concrete shall be deposited in the forms in its final position and shall be placed in layers of uniform thickness. All concrete shall be consolidated by vibratory methods, except concrete deposited in water or unless otherwise specified.

   Vibration shall be internal and applied directly to the concrete, except when the use of other methods is authorized by the Engineer or provided herein. The Engineer will be the final judge as to which sections are unsuited for internal vibration.

   External vibration applied to the concrete through the forms may be required on certain sections such as those which are very thin, very heavily reinforced, or otherwise crowded with material other than concrete, or where form surfaces are sharply including or battered. External vibration may be used alone or in conjunction with internal vibration when necessary to secure dense surfaces. The Engineer will determine when and where external vibration must be used.

   The **Contractor** shall provide a sufficient number of vibrators to properly consolidate each batch immediately after it is placed in the forms and before the next batch is delivered, without delaying such delivery. The vibration shall be of sufficient intensity and duration to thoroughly consolidate the concrete, but it shall not be continued to such an extent as to cause segregation. Vibration shall not be continued at any one point to the extent that any localized areas of grout are formed.

Vibration shall be applied at points uniformly spaced not further apart than twice the radius over which the vibration is visibly effective.

Vibration shall not be used to transport concrete in the forms or to make it flow in the forms over distances so great as to cause segregation. Vibration shall not be applied directly or through the reinforcement or forms to sections or layer of concrete which have hardened to such a degree that the concrete ceases to be plastic under vibration.

Vibration shall be supplemented by such spading, along form surfaces, in corners, and at locations impossible to reach with the vibrators, as is necessary to insure smooth surfaces and dense concrete.

The provisions of this section shall apply to precast concrete cribbing and other precast members or units, except that if approved by the Engineer the manufacturer's methods of vibrating may be used.

b. Internal vibrators shall be of a type and design approved by the Engineer. They shall be capable of transmitting vibration to the concrete at frequencies of not less than 4500 impulses per minute. The intensity of application shall be such as to visibly affect a mass of concrete of 1 inch slumps over a radius of at least 18 inches.

Internal vibration shall be applied directly to the concrete at the point of deposit and in the area of freshly deposited concrete. Vibrators shall be inserted in and withdrawn from the concrete slowly. Internal vibrators shall be manipulated so as to thoroughly work the concrete around the reinforcement and imbedded fixtures and into the corners and angles of the forms.

c. When external vibration is required, the vibrators shall be power operated equipment of the size and frequency approved by the Engineer.

External vibrators shall be clamped to or applied against the forms and operated so as to produce concrete free from honeycomb and having a dense surface free from pockets and entrapped air bubbles. They shall be applied to a level below the top of the concrete being deposited but not so low as to disturb concrete which has partially set. Every precaution shall be taken to avoid damage to or misalignment of the forms.

D. Concrete Surface

1. General

Concrete surfaces shall be finished in accordance with one of the following designations. Unless otherwise specified, all concrete work shall have an "Grout Finish" for vertical surfaces and "Troweled Finish" for horizontal surfaces. Strict compliance with the Specifications and the intent pertaining to finished surfaces will be enforced. Any concrete structure or concrete work that exhibits surfaces with defective finish will not be accepted until finishing has been completed in accordance with the Specifications. All concrete surfaces shall be finished within

24 hours after the forms are removed. If the concrete surfaces are not finished as specified within the time limit mentioned, all other work shall be suspended until the concrete surfaces required to be finished are completed.

Application Structures	Finished Designation
For all concrete surfaces not exposed to public view and not to be waterproofed	Rough Form Finish
For all concrete wall surfaces exposed to public view	Grout Finish
Upper horizontal surfaces	
Headwalls, wing walls, retaining walls, inlet head pieces	Troweled Finish
Tops of Footings	Float Finish
Horizontal construction joints	Left Rough
Slabs & Miscellaneous Paving	Floated Finish
Incidental Works	
Sidewalks, curb, combination curb and gutter, concrete paving, safety curb, median paving	Broom or Belt Finish
Tops of culvert slabs, culvert invert slabs, concrete ditch paving	Floated Finish
Exterior platforms, steps, landings, and pedestrian ramps	Non-slip Finish
Surfaces intended to receive bonded cementitious application	Scratched Finish

2. Rough Form Finish

Immediately following the removal of forms, all fins and irregular projections shall be removed from all surfaces except from those that are not to be exposed or not to be waterproofed. On all surfaces, the cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges, and other defects shall be thoroughly cleaned and, after having been kept saturated with water for a period of not less than 3 hours, shall be carefully pointed and trued with a mortar of cement and fine aggregate mixed in proportions used in the grade of the concrete being finished. Any excess mortar at the surface of the concrete due to filling form tie holes shall be struck off flush with a cloth. The mortar patches shall be cured as specified under Curing. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its length with clean and true edges.

The resulting surfaces shall be true and uniform. All surfaces which cannot be repaired to the satisfaction of the Engineer shall be finished as specified in

Paragraph 03300.03 D.3.

3. Grout Finish

All fins, projections, etc. shall be removed to the satisfaction of, and by means approved by, the Engineer (stone, chipping hammer, sandblasting, etc.). No cleaning operations shall be undertaken until all contiguous surfaces to be cleaned are completed and accepted. Cleaning as the work progresses will not be permitted. The surface of the concrete shall then be saturated with water and kept wet for at least 2 hours. Proceeding by sections, a grout mix of 1-part Portland cement and 1 1/2 parts fine sand with sufficient water to produce a grout having the consistency of the thick paint shall be thoroughly rubbed onto the surface using burlap pads or cork floats completely filling all voids, pits, and irregularities. While the grout is still plastic, remove all unnecessary grout by working the surface with a rubber float or burlap. After this grout has dried sufficiently so that it will not smear, the surface shall be wiped off with dry, clean burlap so as to leave a clean uniform surface. This surface shall then be cured as required, except that only colorless liquid curing compound will be permitted for this method.

4. Scratched Finish

After the concrete has been placed, consolidated, struck off, and leveled, the surface shall be roughened with stiff brushes or rakes before final set.

5. Floated Finish

After the concrete has been placed, consolidated, struck off, and leveled, the concrete shall not be worked further until ready for floating. Floating with a hand float or with a bladed power trowel equipped with float shoes, or with a powered disc float shall begin when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation. During or after the first floating, planeness of surface shall be checked with a 10 ft straightedge applied at not less than two different angles. All high spots shall be cut down and all low spots filled during this procedure to produce a smooth surface. The slab shall then be refloated immediately to a uniform sandy texture.

6. Troweled Finish

The surface shall first be float-finished. It shall next be power troweled, and finally hand troweled. The first troweling after power floating shall produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Additional trowelings shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be essentially free of trowel marks, uniform in texture, and appearance and to a smooth plane.

7. Broom or Belt Finish

Immediately after the concrete has received a float finish, it shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

8. "Dry shake" Finish

If a "dry shake" application of a selected metallic or mineral aggregate is specified, the aggregate, selected or acceptable to the Engineer, shall be blended with Portland cement in the proportions recommended by the manufacturer of the aggregate. The surface shall be given a float finish. Approximately two-thirds of the blended material for required coverage shall be applied to the surface by a method that insures even coverage without segregation. Floating shall begin immediately after application of the first “dry shake”. After this material has been embedded by floating, the remainder of the blended material shall be applied to the surface at the right angles to the previous application. The second application shall be heavier in any areas not sufficiently covered by the first application. A second floating shall follow immediately. After the selected material has been embedded by the two floatings, the operation shall be completed with a broomed, floated, or troweled finish, as designated in the Contract Documents.

9. Nonslip Finish

Where the Contract Documents require a nonslip finish, the surface shall be given a "dry shake" application, as specified above, of crushed ceramically bonded aluminum oxide or other specified selected abrasive particles. The rate of application of such material shall be not less than 25 pounds per 100 square feet.

10. Exposed Aggregate Finish

Immediately after the surface of the concrete has been leveled, and surface water has disappeared, aggregate of color and size (usually 3/8 to 5/8 inch) selected by the Engineer shall be spread uniformly over the surface to provide complete coverage to the depth of a single stone.

The spread of selected aggregate shall be embedded into the surface by light tamping and the surface shall be floated until the embedded stone is fully coated with mortar and the surface has been brought to a true plane. Exposure of the aggregate shall start after the matrix has hardened sufficiently to prevent dislodgement of the aggregate. Water, in abundant quantities but without force, shall be allowed to flow over the surface of the concrete while the matrix encasing the selected aggregate is uniformly exposed but not dislodged.

An acceptable chemical retarder sprayed onto the freshly floated surface may be used to extend the working time for exposure of aggregate.

E. Curing

Provisions shall be made for curing all concrete. Curing shall start as soon as concrete has set sufficiently so that curing applications will not damage the surfaces. Curing will also be

required while protecting concrete against cold weather.

The following are methods to be used for curing:

1. All units of structures which will be below water in the completed structure, i.e. bottom slabs of culverts, footings, struts, etc., may be gradually flooded after the concrete is 12 hours old provided the water meets all specification requirements for curing water. The temperature of this water must be maintained at a temperature of 50°F or above for the specified curing time.

2. Two layers of burlaps shall be used. Successive strips of each layer shall be overlapped a minimum of 6 inches. The second layer shall be placed not less than 45 degrees to the first layer; or the 6 inches overlap of the second layer may be placed midway (one-half width) of the first layer. The layers of burlap shall be kept thoroughly saturated with curing water for the full time specified for curing.

3. When curing concrete structural slabs, etc., burlap-polyethylene mats or white polyethylene sheets may be used atop the wet burlap on unobstructed flat and reasonably level surfaces.

   The burlap-polyethylene mats or white polyethylene sheets shall be placed only on unobstructed flat and reasonably level surfaces. They will not be permitted on vertical surfaces, such as walls, columns, abutments, etc.

   Adjacent mats or sheets shall be lapped no less than 1 foot. The ends shall be brought down around the sides of the concrete being cured and securely fastened to the satisfaction of the Engineer to make an airtight seal that will be unaffected by wind.

   The burlap-polyethylene mats must be placed on no less than one layer of wet burlap with the burlap side of the mat facing down. White polyethylene sheets, if used, must be placed on no less than two layers of wet burlap.

   The burlap-polyethylene mats or white polyethylene sheets must remain in place for the same length of time as required for burlap mats. These protective coverings need not be wetted down; however, the covered burlap or cotton mats must be kept wet for the time interval required by the Specifications.

4. The material for liquid membrane-forming compounds shall have a fugitive dye or be white pigmented. The materials shall be thoroughly agitated before use and applied by sprayers.

5. The burlap must be thoroughly saturated just prior to placement. The requirement for keeping the concrete surfaces saturated at all times during the curing period, regardless of the covering, will be strictly enforced. This saturation of the surfaces must be employed even in areas where there is no ready water supply. The **Contractor** must furnish, at his expense, sufficient water to satisfy this requirement.
   All vertical surfaces may be cured by leaving forms in place for 7 days. If forms are removed after 48 hours, then the remainder of the 7 days of cure shall be by method 3.

Immediately after the finishing operation for sidewalks and culvert top slabs, the areas of future construction joints shall be covered with two layers of wet burlap which shall extend 6 inches outside the joint area. The finished concrete surface shall then be sprayed with a liquid compound as specified in curing method 4. The material shall be applied uniformly at the rate of 150 to 200 square feet per gallon, one half applied in a longitudinal direction and the second half in a transverse direction. After 1 day or as soon as the concrete may be walked upon without damage, the concrete shall be cured using method 2 or 3 for the remainder of the 7-day curing period.

All other horizontal surfaces shall be cured using either method 2 or 3 for a period of 7 days.

Cover tops and other horizontal surfaces of endwalls, and headwalls with burlap; and cover vertical surfaces of same after removal of forms with burlap mats and keep concrete, forms, mats, and/or burlap wet for 3 days.

F. Cold Weather Protection

When the air temperature in the shade and away from artificial heat drops to 40°F or lower at the time of placing or at any time within the number of days specified below for protection, concrete shall be protected and heated after it has been placed. Protection and heating shall be as follows:

1. Ordinary concrete shall be protected and kept continuously at a temperature not less than 50°F for at least 7 days following placement.

2. In no case shall concrete be heated to more than 100°F. At the end of the heating period, the concrete surfaces shall be cooled to the temperature of the outside air by slowly reducing the artificial heat at a uniform rate until the temperature of the outside air is reached within a 24 hours period.

The **Contractor** shall have available enough tarpaulins, insulating devices, and/or other suitable materials to enclose or protect all portions of the concrete requiring protection. As much as possible of the aforesaid devices and materials shall be installed before placing the concrete, and the remainder shall be installed as rapidly as possible to keep exposure to cold weather to a minimum. Where heating is required, the spaces to be heated shall be completely enclosed and the temperature therein kept at required levels by the use of approved heaters.

Insulated devices (wrappings), if proposed for use, shall be first submitted to the Engineer for approval; and if acceptable, they may be used, provided that satisfactory protective performances under prior usage can be verified. Where the insulating devices are in tight contact with forms of concrete surfaces, satisfactory instruments and usage thereof shall be devised and placed in operation to prove to the Engineer that required temperatures are being maintained under the insulators.

All structure concrete requiring cold weather protection and having curing periods less than the cold weather protection period shall be cured for the full cold weather protection period.

The **Contractor** shall provide a sufficient number of maximum minimum recording thermometers to record the temperatures in each concrete pour undergoing cold

weather protection.

The responsibility for defective concrete by reason of heating or lack of heating, or any other hazards incidental to cold weather concreting, shall remain with the **Contractor**; and such defective concrete shall be replaced by him at his sole expense.

Concrete in place shall be protected to minimize drying and absorption of heat when and as directed by the Engineer.

G. Underpinning

Where structures are extended, widened, or repaired, it is frequently found that the foundations of the old structure are not in solid or full area bearing on their intended foundations. Frequently, foundations of the extended or new parts are at a lower elevation than the former foundations. These conditions usually led to the necessity of underpinning the old structure, which operation shall consist of the restoring or lowering of the old foundations with concrete masonry. The concrete masonry shall be Mix No. 6. Excavation and the underpinning operations shall be done in part section, so as not to remove more than 10% of the supporting area under the old foundation at one time. The concrete shall be mixed to a stiff consistency (slump not to exceed 1 1/2 inch). The underpinning masonry shall usually be applied by hand, well inserted, pushed, rodded, or tapped into position. Where specified, underpinning masonry shall be installed by pneumatic or pumping processes. The usual curing and cold weather requirements will be deleted for underpinning masonry with other provisions for curing and protection improvised on the job as may be directed.

H. Prevention and Removal of Stains on Concrete

The **Contractor** shall prevent rust of unpainted structural steel, staining by bituminous materials, or any other substance from discoloring any portion of the concrete. The **Contractor**, therefore, shall devise and use construction procedures or methods that prevent staining of any of the concrete. If, however, any portion of the concrete is stained, the **Contractor** shall remove such stains and restore the concrete to its original color without damage to the concrete all at his expense and as approved by the Engineer. No chemical solvents will be allowed unless previously approved by the Engineer.

4.01 METHOD OF MEASUREMENT

Measurement for cast-in-place concrete of the mix number specified will be made on a unit area or volume, or a lump sum per structure basis. In establishing the breakdown between footing concrete and substructure concrete, the divisions line shall be the top of footing regardless of where the construction joint occurs.

A. Unit Price

Measurement for cast-in-place concrete, when a unit price is provided for in the Proposal, will be made on an area or volume basis for the actual amount of concrete satisfactorily placed and accepted.

B. Lump Sum

Measurement for cast-in-place concrete, when a lump sum price or prices per structure are provided for on the Proposal Form, will be made on the basis of a lump sum for all concrete included in the Project or on the basis of the number of structures satisfactorily placed and accepted.

5.01 BASIS OF PAYMENT

A. General

1. Payments will be made at the unit and/or lump sum prices bid. The prices shall include all materials, forms, reinforcing steel, curing materials, sealing, caulking, and dampproof or waterproofing, and all necessary equipment, tools, labor, and work incidental thereto in accordance with the Contract Documents.

2. Unless otherwise specified, payment for footing and subfoundation concrete will be made on a unit price basis.

3. Payment will be made for contingent items when ordered by the Engineer. Payment will be specified in Section 02951, 02952, 02953, 02954, 02955, 02956, and 02957.

B. Unit Price

Payment for cast-in-place concrete will be made at the price bid per cubic yard for the various mix numbers specified.

C. Lump Sum

1. Payment for cast-in-place concrete will be made at the lump sum price bid for all concrete on the Project, or for all concrete in each structure or structural unit as indicated in the Proposal.

2. To provide for unforeseen changes in planned dimensions affecting concrete on a lump sum basis, the Proposal may include an item(s) for contingent concrete. This item(s) shall be used only upon written direction of the Engineer and applies only to referenced structure(s). If necessary changes in the planned dimensions result in an enlargement, then the pertinent lump sum price shall be increased by an amount obtained from the product of the increase in volume times the unit price bid per cubic yard on the pertinent contingent concrete item. Should, however, the necessary changes result in a smaller structure than planned, then the pertinent lump sum price shall be reduced by an amount obtained from the product of the reduction in volume times the unit price bid per cubic yard on the pertinent contingent concrete item. The unit price bid on the pertinent contingent concrete item shall include cost of all concrete, reinforcing steel, expansion material, damp proofing, membrane waterproofing, formwork, incidental materials, etc. and work required to complete the structure(s) as revised.

+++ END OF SECTION 03300 +++

SECTION 03310
PORTLAND CEMENT CONCRETE

1.01 GENERAL

A. Description

Portland cement concrete shall include, but not necessarily be limited to, furnishing various strengths of Portland cement concrete as specified in the Contract Documents.

B. Related Work Included Elsewhere

Not applicable.

C. Quality Assurance

1. Inspection

The Engineer will inspect all materials before and/or after installation to ensure compliance with the Contract Documents. When specific materials tests are called for in the referenced standards and specifications, the Engineer will have the option of requiring that any or all of these tests be performed for materials furnished for a specific Project. When testing is required, it will be specified herein or in the “Special Provisions”.

2. Mixes

All mixes furnished shall have been approved by the Maryland State Highway Administration for use on State highway work and produced in plants approved by the State Highway Administration.

3. Control Testing

The **Contractor** shall furnish the necessary molds meeting the requirements of AASHTO M 205. Control testing shall be in accordance with the following requirements:

Test	Method	Min Test Frequency	Responsibility
Slump	AASHTO T 119	1 per 50 cu. yds. or fraction thereof - min 2 per day	Engineer
Air Content	AASHTO T 52 (N0TE 3) or T 196	1 per 50 cu. yds. or fraction thereof - min 2 per day	Engineer
Compression	AASHTO T 22 and T 23 except that MSMT 504 may be used in lieu of AASHTO T 231	1 per 100 cu. yds or fraction thereof: as randomized and directed by the Engineer – min 2 tests per day	Molding, curing, and delivery to an approved laboratory by the **Contractor** after a 1- to 3-day storage period
Split Tensile Mix No. 7 only	AASHTO T 198 plus	3 per day- 4 specimens per test optional early strength tests	Same as for Compression

NOTE 1: A second test will be made if the first slump or air content test fails. The concrete will be accepted or rejected on the basis of second test results.

NOTE 2: Mix No. 7 concrete is required to gain 300 psi strength before opening to traffic.

NOTE 3: Air meter will be calibrated in accordance with MSMT 505.

4. Quality Control During Construction

a. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days for determination of the compressive strength of the concrete.

b. Strength level of an individual class of concrete shall be considered satisfactory if both of the following requirements are met:

1) Average of all sets of those constructive strength tests equal or exceed the required 28-day compressive strength indicated in paragraph 03310.03 A.

2) No individual strength test (average of two cylinders) falls below the required 28-day compressive strength by more than 500 psi.

c. If either of the above requirements are not met, steps shall be taken to increase the average of subsequent strength test results. If the strength test of laboratory-cured cylinders falls below the specified strength value by more than 500 psi steps shall be taken, if required by the Engineer, to assure that load-carrying capacity of the structure is not jeopardized. The Engineer may require cores drilled from the area in question in accordance with ASTM C 42. In such cases, three cores will be taken by the **County** for each strength tests more than 500 psi below the required 28-day compressive test. Concrete in an area represented by core tests shall be considered structurally adequate if the average of three cores is equal to at least 85% of the required 28-day compressive strength and if no single core test is less than 75% of the required 28-day compressive strength.

d. If the above criteria are not met, the **Contractor** shall remove and replace the concrete in question at no additional cost to the **County**. If the concrete is acceptable, the additional testing will be at the expense of the **County**, but if the concrete is not acceptable, the additional testing will be at the **Contractor's** expense.

D. Submittals

1. Mill Test

The **Contractor** shall furnish a certified copy of mill tests on each load of cement delivered to the batching plant. The tests shall show the cement's physical and chemical analysis.

2. Control Curves

The **Contractor** shall furnish manufacturer's curves for all high range water reducer admixture. The curves shall show the fluid ounces of high range water reducer per 100 pounds of cement as related to water reduction and strength gain for 12 hours when used with a cement factor of a minimum of 700 pounds.

3. Mix

The **Contractor** shall submit to the Engineer the proportions of materials to be used for each concrete mix. The mixture shall meet the requirements of Section 03310.03 and consist of Portland cement, fine aggregate, coarse aggregate, water, and such admixtures as may be specified.

4. Load Tickets

The producer shall provide and issue, in duplicate, tickets for each load. Each ticket shall show the following:

a. Contract number;

b. date;

c. mix number;

d. number of cubic yards;

e. truck number;

f. time loaded for dry batched material or time water was added for central mixed material;

g. ounces of air entraining agent and other types of admixtures, if applicable, per cubic yard.

h. the moisture content of the coarse and fine aggregates in excess of the saturated surface dry condition;

i. the maximum mixing water that can be added at the job site based on the maximum w/c ratio; (Actual water required for mixing will normally be less than the maximum. In central mix plants, the actual water used shall be shown. Maximum allowed slump shall not be exceeded). Additional mixing of 50% of the total mixing time will be required.

In addition, each load ticket shall contain a certification stating that all materials comply with pertinent specifications and the approved design.

Regardless of the quantities involved, the Engineer will conduct the normal job control tests, i.e. slump and air content on the plastic concrete and making test cylinders.

2.01 MATERIALS

A. Materials Furnished by the **County**

1. The **County** will not furnish any materials for Portland cement concrete.

2. The **Contractor** may purchase water from the **County**'s potable water system in accordance with the current **County** policies and procedures.

B. **Contractor's** Options

1. The **Contractor** may furnish higher strength concrete than specified.

2. Fly ash may he used as a replacement for cement as specified.

C. Detailed Material Requirements

1. Portland Cement

Portland cement shall be in accordance with AASHTO M 85 with the fineness determined in accordance with AASHTO T 153 and the time of setting determined in accordance with AASHTO T 131.

2. Fine Aggregate

Fine aggregate shall meet the gradation requirements contained in Table 03310-1 and shall be in accordance with the quality requirements of AASHTO M 6 except:

a. The maximum permissible limits for deleterious substances apply.

b. The uniformity of grading requirements is deleted.

c. In areas exposed to traffic, only natural sand shall be used.

3. Coarse Aggregate

Coarse aggregate shall be in accordance with the Class A quality requirements of AASHTO M 80 using sodium sulfate to determine the soundness. Grading of aggregate shall be in accordance with AASHTO M 43, size numbers 57, 67, or 7, Table 03310-1.

4. Aggregate Gradations

TABLE 03310-1

Mass Percent Passing

Sieves Sizes	AASHTO M 43			AASHTO M 6*
U.S. Standard	No. 57	No. 67	No. 7	FA, PCC
1-1/2 inch	100	-	-	-
1 inch	95-100	100	-	-
3/4 inch	-	90-100	100	-
1/2 inch	25-60	-	90-100	-
3/8 inch	-	20-25	85-100	100
No. 4	0-10	0-10	0-15	95-100
No. 8	0-5	0-5	0-5	-
No. 16	-	-	-	45-85
No. 50	-	-	-	10-30
No. 100	-	-	-	0-10

*Modified

5. Water from Other Than Potable Sources

Water shall meet the pH requirements of AASHTO T 26, Method B. Water shall not smell or be discolored. Water suspected of questionable quality shall meet limits of the comparison tests with distilled water in accordance with AASHTO T 26. The chloride concentration of water used in mixing and curing of Portland Cement will be determined in accordance with ASTM D 512 and shall not have a chloride concentration exceeding 1000 ppm. The maximum water soluble chloride ion content in the concrete shall not exceed 15% by weight of cement.

6. Chemical Additives for Concrete

Chemical additives for concrete shall not contribute more than 200 ppm of chlorides based on the cement content when tested in accordance with MSMT 610. The relative durability factor of concrete with chemical additives shall be determined in accordance with ASTM C 666, Procedure B.

a. Air Entraining

Air entraining admixtures shall be in accordance with AASHTO M 154.

b. Chemical

Chemical admixtures shall be in accordance with AASHTO M 194.

c. High Range Water Reducing Admixtures

When specified, high range water reducing admixtures shall be liquid and meet the requirements of AASHTO M 194, Type F or G. When this material is used in patching, the admixture shall be liquid and meet the requirements of AASHTO M 194, Type F, for air entrained concrete with the following exceptions.

1) The water content shall be a maximum of 85% of that of the control.

2) The relative durability factor shall be a minimum of 90 when tested in accordance with ASTM C 666, Procedure B.

3) The 12 hour compressive strength for Type F admixture shall be 180% of that of control.

Additionally, the admixture shall be nonfoaming when tested in accordance with ASTM D 1173. It shall not contribute more than 200 ppm of chlorides based on the cement content when tested in accordance with MSMT 610.

The Engineer will determine the minimum dosage rate of admixture to be used in the field.

7. Fly Ash

Fly ash shall be in accordance with AASHTO M 295, pozzolan Class C or F, except:

Loss on ignition, for Mix Nos. 3 and 6	% max	3.0
Moisture content,	% max	1.0

3.01 EXECUTION

A. Concrete Mixes

The concrete shall be proportioned by weight. Water and chemical additives may be proportioned by volume or weight. The mix shall be homogeneous, placeable, and uniformly workable.

Coarse aggregate shall be maintained at a uniform moisture content at least equaling its absorbed moisture. Water, if used for wetting, shall meet the requirements of Section 03310.02.

Portland cement concrete shall meet the following requirements:

Mix No.	28 Day Specified Design Compressive Strength (psi)	Min Cement Factor pounds per cubic yard	Coarse Aggregate AASHTO M 43 Size Number	Max Water/ Cement Ratio	Slump (Inches)
1	2500	470	57 or 67	0.55	2-5
2	3000	560	57 or 67	0.50	2-5
3	3500	610	57 or 67	0.50	2-5
4	3500	650	57 or 67	0.45	4-8
5	3500	610	7	0.50	2-5
6	4500	650	57 or 67	0.45	2-5
7	350 Split Tensile	610	57	0.50	1 1/2-3

NOTE 1: Mixes using size number 57 aggregate shall contain 5% ± 1 1/2% air. Mixes using number 67 aggregate shall contain 6 ± 2% air except Mix No. 4. Mix No. 4 shall only be used for placing concrete under water by a tremie method.

NOTE 2: When concrete is exposed to water exceeding 15,000 ppm sodium chloride content or to sewage, Type II cement shall be used. Type I or Type II cement shall be used for all other concrete.

NOTE 3: Type D-Retarding Admixture or Type A-Water Reducing Admixture shall be added to concrete. If a High Range Water Reducing Admixture, Type F or Type G, is specified, the slump requirement shall be 4 to 8 inches.

NOTE 4: The **Contractor** may request to substitute a minimum of 15% of the weight of cement with fly ash. When fly ash is used, the minimum cement factor and water cement ratio would be determined on the basis of combined weight of the cement and fly ash.

B. Mixers and Agitators

1. All mixers shall display a current Maryland State Highway Administration approval stamp. Mixers and agitators and mixing and delivery of ready-mixed concrete shall meet the requirements of AASHTO M 157 with the following exceptions:

a. Transit mixed concrete will not be permitted. The following requirements shall apply when additional water is added on the job site:

1) No water shall be added after partial discharge of the batch.

2) The water-cement ratio shall not be exceeded.

3) The material shall be mixed a minimum of 20 additional revolutions even though the maximum of 100 revolutions may be exceeded.

4) Acceptance will be based upon a retest of the slump and air content.

b. All concrete shall be discharged within 1 hour after the mixing water is added or 1 1/2 hours after the addition of the cement to the aggregates, whichever is the lesser time.

c. No mixer or agitator containing free water in the drum shall be loaded.

d. Should the timing device on a stationary mixer become broken or out of order, the **Contractor** will be permitted to operate while it is being repaired if he furnishes an approved time piece with minute and second hand. If the timing device is not placed in good working order within 72 hours, further use of the mixer will not be permitted until satisfactory repairs are made.

e. When the concrete is specified or permitted to be made by volumetric batching and continuous mixing, the batching and mixing unit shall meet the applicable requirements of ASTM C 685.

2. Where no mixer performance tests are made for stationary mixers, the minimum time shall be 75 seconds, unless a greater mixing time is recommended by the mixer manufacturer. The mixing time may be reduced to a point at which satisfactory mixing is accomplished as determined by mixer performance tests in accordance with ASTM C 94, but in no case, shall this time be less than 45 seconds. The mixer performance test shall be repeated whenever the concrete indicates that adequate mixing has not been accomplished. Mixing time shall begin when all ingredients are in the mixer drum.

+++ END OF SECTION 03310 +++

SECTION 03320
FLOWABLE FILL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. **Contractor** shall furnish and place controlled low strength material (CLSM) bedding in the Abandoned 24”-diameter Force Main and where shown in the DRAWINGS. The new 8”-diameter HDPE pipeline shall be installed to the proper lines, grades, and dimensions and CLSM placed under, along the sides, and on top of the pipe. Unless otherwise shown in the DRAWINGS, the Abandoned 24”-diameter Force Main shall be completed filled with CLSM.

1.2 NOT USED

1.3 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):

a. C33, Standard Specification for Concrete Aggregates.

b. C94, Standard Specification for Ready-Mixed Concrete.

c. C143/C143M, Standard Test Method for Slump of Hydraulic-Cement Concrete.

d. C150, Standard Specification for Portland Cement.

e. C494/C494M Rev A, Standard Specification for Chemical Admixtures for Concrete.

f. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

g. D4832, Standard Test Method for Preparation and Testing of Controlled Low Strength (CLSM) Test Cylinders.

h. D5971, Standard Practice for Sampling Freshly Mixed Controlled Low-Strength Material.

i. D6023, Standard Test Method for Density (Unit Weight), Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low-Strength Material (CLSM).

j. D6024, Standard Test Method for Ball Drop on Controlled Low-Strength Material (CLSM) to Determine Suitability for Load Application.

k. D6103, Standard Test Method for Flow Consistency of Controlled Low-Strength Material (CLSM).

1.4 SUBMITTALS

A. A minimum of two (2) days prior to starting CLSM WORK. Provide product data on the following:

1. CLSM mix design

2. Fly Ash

3. Admixtures

PART 2 PRODUCTS

2.1 MATERIALS

A. General:

1. The CLSM bedding shall consist of a mixture of sand, coarse aggregate, cement and water.

2. Fly ash and approved admixtures may be used to obtain the required properties of the mix.

3. The mix shall have good workability and flowability with self-compacting and self-leveling characteristics.

4. No changes shall be made in the amounts or sources of the approved mix ingredients without the approval of Engineer.

5. Product inspection and field-testing of the approved mix may be made by, or on behalf of the **County**.

B. Cement: All cement used shall be Type II Portland cement which shall conform to the requirements of ASTM C150.

C. Fly Ash: Fly ash may be either Class C or Class F. The fly ash shall conform to ASTM C618.

D. Aggregates:

1. Fine Aggregate: All fine aggregate shall conform to the grading and quality requirements of ASTM C33.

2. Coarse Aggregate: Coarse aggregate shall conform to the grading and quality requirements of ASTM C33 for size No. 476, No. 57, or No. 67.

E. Water: The batch mixing water and mixer washout water shall conform to the requirements of ASTM C94.

F. Admixtures:

1. Chemical admixtures that do not contain calcium chloride and conform to ASTM C494/C494M for concrete may be used in the CLSM mix.

2. All chemical admixtures shall be compatible with the cement and all other admixtures in the batch.

G. CLSM Proportions:

1. Strength: CLSM shall have a minimum twenty-eight (28) day compressive strength of one hundred (100) psi when molded and cured as in conformance with ASTM D4832.

2. The CLSM shall have a minimum cement content of fifty (50) pounds per cubic yard. The water-cementitious materials ratio of the mix shall not exceed three and one-half to one (3.5:1).

3. Air-Entrainment: All CLSM shall be air entrained to a total air content of approximately five percent (5%).

4. Slump: The minimum slump shall be six (6) inches and the maximum slump shall be eight (8) inches when tested in accordance with ASTM D6103.

5. Aggregate: Fine aggregate shall be between fifty percent (50%) and sixty percent (60%) by volume of the total aggregates in the CLSM mix.

H. Consistency:

1. The consistency of the CLSM slurry shall be such that the material flows easily into all openings between the pipe and the lower portion of the trench.

2. When trenches are on a steep slope, a stiffer mix of slurry may be required to prevent CLSM from flowing down the trench.

3. When a stiffer mix is used, vibration shall be performed to ensure that the CLSM slurry completely fills all spaces between the pipe and the lower portion of the trench.

PART 3 EXECUTION

3.1 GENERAL

A. CLSM shall be placed as closely behind pipe laying operations as possible.

B. CLSM shall not be placed, if, in the judgment of Engineer, weather conditions are unsuitable.

C. CLSM shall not be placed when the trench bottom or walls are frozen or contain frozen materials.

D. CLSM shall not be placed when the air temperature is below forty degrees Fahrenheit (40°F) unless the air temperature is thirty-five degrees Fahrenheit (35°F) or more and the temperature is rising.

E. CLSM shall be protected from the freezing for at least 24 hours after placement.

3.2 PLACEMENT

A. CLSM shall be placed under the pipe from one side so that it flows under the pipe until it appears on the other side.

1. CLSM shall be added to both sides of the pipe until it completely fills the annular space between the pipes as shown in the Drawings.

2. Rodding, mechanical vibration and compaction of CLSM shall be performed to assist in consolidating the CLSM.

B. When required to prevent uplift, the CLSM shall be placed in two (2) stages as required, allowing sufficient time for the initial set of the first stage before the remainder is placed.

C. CLSM shall be deposited as nearly as practical in its final position and in no way disturb the pipe or cause foreign material to become mixed with the CLSM.

END OF SECTION