WATER AND WASTEWATER STANDARDS AND SPECIFICATIONS

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SECTION 1.1 - POLICIES AND PROCEDURES

1.01 SCOPE AND INTENT

The intent of these Policies and Procedures is to establish minimum requirements and guidelines for potable water and sanitary sewer projects - including water mains, gravity sewers, sewage pump stations and force mains - constructed in Barrow County. The procedures will apply to all water and sewer development and construction projects, both public and private, within the jurisdiction of Barrow County.

The procedures shall also apply to all existing water and sanitary sewer facilities - including septic tanks - which are being upgraded or have failed and are being corrected, both public and private, within the jurisdiction of Barrow County.

Before any proposed project can be considered or reviewed for approval, verification must be provided to ensure the project is consistent with the current Barrow County Service Delivery Strategy.

1.02 DEFINITIONS

A. Contractor: Utility contractor possessing valid Georgia Utility Contractor's License.

B. County: Board of Commissioners, Barrow County, Georgia or its authorized representative.

C. BCWSS: Barrow County Water and Sewer System or its authorized representative.

D. Water System: The Barrow County water supply system, including water storage tanks, pumps, piping, hydrants, valves, lines, mains, meters and all other appurtenances.

E. Sewer System: The Barrow County sewer system, including sanitary sewers, pump stations and treatment facilities.

F. Owner or Developer: Any person, firm, corporation, association, partnership or agent thereof who undertakes or proposes to construct or extend water or sewer facilities to serve a residential subdivision, industrial park, apartment complex, condominium, commercial or industrial institutional establishment.

G. EPD: Environmental Protection Division of the State of Georgia Department of Natural Resources (DNR).

H. ERU: Equivalent Residential Unit. A housing unit that meets the needs of a single-family residential unit. For example, a 10-unit apartment building would house 10 ERU's.

I. Standards: Latest revision of the Water and Sewer System Standards adopted and published by the County.

J. Professional Engineer: A registered, practicing engineer, licensed by the State of Georgia.

1.03 VARIANCES

Under special conditions with specific applications, a variance to the Policies and Procedures may be granted to meet certain conditions that are beyond the control of the Developer, provided such alterations or deviations are acceptable to the County. Final decisions concerning such alterations shall be made by the Board of County Commissioners or its designee.

1.04 PRE-DESIGN CONFERENCE

It is recommended that each Owner or Developer initiate a pre-design conference between himself, his engineer, and the BCWSS Director or his designated representative.

1.05 PROCEDURES

Developers shall plan for and carry out construction of water and sewer facilities in accordance with the following procedures.

A. For water system improvements, the Developer shall provide a letter of intent stating the desire to obtain water from BCWSS and provide payment of the appropriate fee(s). Included with the letter, the developer shall provide three (3) copies of the property plat, which shows the number of lots proposed within the subdivision.

BCWSS will review water system plans, conduct a field pressure and flow test, and analyze the collected data regarding the site. Based upon the review, BCWSS will either approve or make comment upon said plans regarding the available pressure and flows for the subdivision. Off-site improvements or upgrade of the County water system may be required where sufficient flow and pressure is not available to serve the proposed development. All costs for design, easement acquisition and construction of required public water system improvements to support the proposed development, as determined by Barrow County, shall be paid for solely by the Developer or applicant.

B. For wastewater system improvements, BCWSS will prepare a submittal for EPD review to include a transmittal letter by the professional engineer preparing the design for the project. This letter should be addressed to the Barrow County Planning Department and shall specifically address the following items:

1. State whether odor complaints may be generated by construction of this project. If odor is expected or deemed to be a potential issue, odor control solutions may be required at the discretion of BCWSS.

2. Complete and submit an EPD Sanitary Sewer Extension Submittal Form for certification by BCWSS.

3. Provide a statement to the reviewer indicating whether or not any of the sewers, services or other utilities associated with the project will be constructed on a solid waste landfill site.

4. Provide a copy of the Report of Technical Review (ROTR) by the Soil and Water Conservation District/Natural Resource Conservation Service.

5. When the project includes a pump station, the following pumping system design parameters shall be submitted by the Developer's engineer for forwarding to EPD:

a. Total Dynamic Head (TDH) calculations, in tabular form.

b. Net Positive Suction Head (NPSH) calculations.

c. Static Head.

d. Pump Curves from the proposed acceptable pump manufacturers.

e. Pump Curves from the backup pumping system.

f. Specifications from the backup pumping system.

g. System head curve.

h. Wetwell volume.

i. Pump cycle time.

j. Pump station and force main friction losses.

k. Wetwell buoyancy calculations.

l. Force Main diameter and length

m. Force main material of construction

C. The Developer or Project Engineer shall obtain all required permits and approvals including, but not limited to, land disturbance permits, stream buffer variances, and U.S Army Corps of Engineers permits. A copy of all required permits and approvals shall be provided to BCWSS prior to plan approval.

D. Upon acquiring all appropriate permits and approvals, the Developer shall provide three (3) copies of the construction plans to BCWSS for review.

E. BCWSS will review the construction plans and either approve or make comments. Utility construction plans will be returned to the Developer for corrections or with approval. One approved copy of the utility construction plans will remain in the BCWSS office. With written approval, the Developer must begin construction within one year.

F. BCWSS must pre-approve all materials and vendor products prior to construction. All shop drawings will be reviewed by BCWSS.

G. The Developer or Project Engineer shall contact and schedule a pre-construction conference with BCWSS inspection personnel prior to initiating construction activities.

H. The Developer shall notify BCWSS two (2) business days before beginning construction.

I. The Developer must obtain regular inspection from BCWSS of all work in progress. Frequency of inspections shall be as determined in the pre-construction conference.

J. At any time during construction the inspector or a BCWSS representative may deem it necessary, due to operational, field conditions, and or safety concerns, to vary from the approved plans and/or this manual. The Contractor must obtain the written approval of the project's engineer and the BCWSS inspector prior to the installation of any field changes.

K. An inspection by BCWSS will be performed with the Contractor and Developer after all facilities have been installed to ensure the facilities meet the requirements regarding pressure, flow, etc. This inspection does not relieve the developer of any requirements listed in these Specifications. Acceptance of the facilities after construction does not relieve the Developer of meeting all BCWSS requirements at the time of final plat.

L. Record drawings or "As-Builts" shall be provided before written final acceptance is provided. No potable water transported through the new water lines may be sold to any customer or customers and no discharges of sewage to the new collection system facilities shall be made until such time as BCWSS approval of the "As-Built" drawings is given.

M. BCWSS will make final inspection for acceptance when the facilities are properly installed and all inspections and tests are successfully completed.

N. A letter of acceptance will be issued after a satisfactory final inspection has been conducted and title to all water mains and sanitary sewers has been conveyed to BCWSS. The Developer shall provide a written warranty which has a minimum one-year period starting the date that the final plat is recorded.

1.06 CONNECTION TO EXISTING SYSTEM

A. New connections to the existing BCWSS utility system are subject to all County standards, specifications, codes, and ordinances as they pertain to water or sewer systems and/or facilities. Off-site improvements or upgrade of the County water and/or sewer system may be required where sufficient flow, pressure or capacity is not available to serve the proposed development. All costs for design, easement acquisition and construction of required water and/or sewer system improvements to support the proposed development, as determined by Barrow County, shall be paid for solely by the Developer or applicant.

B. Connection of private sewage pump stations, force mains and gravity sewers shall be considered on a case-by-case basis only. Service laterals and connections serving only one customer (as defined in Sections 3.06, 3.07 and 3.08 of this Article) are not considered private sewers and are the customer's responsibility for maintenance.

C. Under no circumstances shall any storm water facilities be connected to the County water and sewer systems.

1.07 EXISTING DEVELOPMENT REGULATIONS

The requirements of these Policies and Procedures for water and sewer systems shall be in addition to the requirements of the Barrow County Subdivision Regulations.

1.08 CONVEYANCE OF EXTENSION TO UTILITY SYSTEM

A. The Developer shall construct and convey to the BCWSS, free and clear of all encumbrances and at no cost to the BCWSS, all water and sewer system improvements.

B. Following conveyance by the Developer, the extension and any additions, repairs and replacements thereto shall at all times remain the sole, complete and exclusive property of and under the control of the BCWSS, and the Developer shall have no right or claim in or to the Developer's extension; provided, however, that the extension shall be used for providing service to the development.

1.09 FEES

A. Connection Fee: Connection fees shall be charged for each establishment, structure and use added to the County water and/or sewer system. Prior to receiving final approval from the County, the Developer will pay the current connection fee presently charged for connections to the County water and/or sewer system as stipulated in the pertinent county code establishing rates, charges and regulations for water and/or sewer systems.

B. Sewer Capacity Fee: A sewer capacity fee shall be charged for each establishment, structure and use added to the County sewer system. The Developer and/or builder will pay the current Sewer Capacity Fee presently charged for connections to the County Sewer System as stipulated in the pertinent county code establishing rates, charges and regulations for sewer systems.

C. Planning and Inspection Fees: The Developer shall pay a planning, inspection and review fee in order to defray all actual costs to the County, including any attorneys' fees, of:

1. Conducting the review of the engineering plans and specifications;

2. Conducting the inspection and testing of the installation of the water and/or sewer extension; and

3. All other administrative costs incident to either accepting the extension into the County water and/or sewer system or becoming trustee of a non-county-owned system.

D. Fees shall be paid in full prior to receiving County approval of plans and specifications.

1.10 GRANT OF EASEMENT RIGHTS

A. Developer shall grant to the County, its successors and assigns, the exclusive perpetual right, privilege and easement to construct, reconstruct, operate, maintain, repair, replace, improve, alter, remove, relocate and inspect water and sewer system facilities over, across and under the strip of land wherein system lies on the Developer's property, together with the right of ingress and egress to each of the building sites on Developer's property which are to be served by the BCWSS. The easement rights granted with respect to public places shall be subject to the authority of the public authority having jurisdiction over such public places.

B. Prior to the County providing service to the development, the Developer shall execute a grant or grants of easement, in recordable form to be approved by the County, specifically granting to the County the above rights necessary, in the discretion of the County to provide water and/or sewer service to the Developer's property.

C. Nothing shall prevent Developer or any subsequent owner of Developer's property from exercising itself or granting exclusive or non-exclusive rights, privileges and/or easements to any other parties for the furnishing of utility services other than sewerage, provided that the County's use, occupancy and enjoyment of its easements are not unreasonably interfered with. Use of the easement for any purpose other than sewer will require approval by the County.

D. The County shall not be obligated to furnish any sewer service to any building which may be built on Developer's property to which it does not have access.

1.11 UNDERGROUND UTILITY CONTRACTOR

A. All extensions and additions to the BCWSS water and sewer systems shall be performed by a Georgia Licensed Utility Contractor. The Utility Contractor shall provide to BCWSS copies of all current Georgia Licenses including, but not limited to, their business license, Utility Contractor License, and Utility Manager License.

B. The Utility Contractor shall maintain a liability insurance policy in the amount of at least $1,000,000.00 until the conveyance of the utility system. A copy of the insurance shall be provided to BCWSS before any work shall commence.

C. The County reserves the right to approve or disapprove the utility contractor(s) or subcontractor(s).

1.12 PLANS AND SPECIFICATIONS

A. All engineering plans and specifications shall be reviewed and approved by BCWSS. Plans shall be prepared, signed and sealed by a professional engineer. Plan approval is valid for 12 months from the date of acceptance by BCWSS. A written request for an extension of the expiration date must be submitted for review and approved by BCWSS 30 days prior to the expiration date. This process must be repeated every 12 months until construction is completed and accepted by BCWSS.

B. Extension of plan approval is not guaranteed. Current approved County Specifications may require changes to an originally submitted construction plan. For example: changes in design specifications and materials for construction.

C. The plans shall include the following:

1. A cover sheet containing the following information:

a. Title of the Project

b. Owner/Developer's name, address, phone number and fax number

c. Engineer's name, address, phone number and fax number

d. Funding source (i.e. private, state or federally funded)

e. Project Location Map (map shall have a north arrow with indicated scale, and shall be legible and detailed enough for someone not familiar with the project to find the project site.)

f. A copy of the FEMA map with the project site outlined or shaded on the map. The actual map must be copied onto the cover, not just the FIRM or panel number. The 100-year flood elevation must be indicated on the plans.

g. Drawing sheet index

h. The Utility Protection Center "Call Before You Dig" logo and phone number

2. A legend of symbols used on the plans (may be included on the cover sheet or on the first sheet of the plans).

3. A note on each plan sheet stating "Contractor shall call the Utility Protection Center "Call before you dig" 800.282.7411 prior to commencing any excavation work on the project".

4. A standard detail sheet. These details shall be the same as included in the BCWSS Standards.

5. A plan sheet of the overall development (on one sheet if possible) that shows all water lines, gravity sewers, force mains and water service and sewer laterals for each lot. This plan should show the street edge of pavement, right-of-way, lot lines, and water and sewer utilities only. All other utilities and contours should be excluded from this plan sheet.

D. As a minimum, for the following types of facilities, the plans shall include:

1. Sewer Systems

a. Scale:

i. Gravity sewers and force mains at a scale no smaller than 1 inch = 50 feet horizontal and 1 inch = 10 feet vertical.

ii. Pump station site plan scale no smaller than 1 inch = 20 feet.

b. The slope of the sewer, the length of pipe segment and the pipe material between manholes on the profile sheets.

c. Stations of manholes on plan and profile sheets.

d. State plane coordinates of manholes on plan sheets.

e. Manhole numbers containing alpha-numeric nomenclature with the first character being a letter identifying the sewer line segment followed by a dash and sequential numbers identifying each sequential manhole located within that sewer line segment (e.g. A-1 is the first manhole in the sewer line segment A and B-2 is the second manhole in sewer line segment B).

f. Manhole rim and invert elevations on profiles.

g. Locations of air release valves.

h. Pumping station details

i. Materials of construction with specifications.

j. Supplemental attachments.

i. Pump curve

ii. Release valve information

iii. Calculations including but not limited to pipe sizing, velocity wet well sizing, buoyancy, and release valve sizing.

2. Water Lines and Elevated Water Storage Tanks

a. Water services, fire hydrants, valves.

b. Scale no smaller than 1 inch = 50 feet.

c. Location of valve vault, access road, altitude valve, hydrant, well building, parking area, and fence.

d. Materials of construction with specifications.

E. Indicate on the plans whether or not the project is located within a flood zone. When a body of water is located adjacent to the proposed gravity sewer, force main, pump station or treatment facility, indicate the 100-year flood zone elevation and graphically show the flood zone boundary of the stream/river on the plans. If flood elevations are not available, the Developer shall determine the 100-year flood elevation to insure facilities are not located within flood prone areas.

1.13 INSTALLATION AND INSPECTION

Water and sewer system facilities shall be constructed in accordance with the engineering plans approved by the County. The County shall have the right, but not the obligation, to make inspections as installation progresses. Field revisions to approved plans must be submitted in writing with documentation. The revisions must be reviewed and approved by BCWSS prior to construction of requested revision.

1.14 TESTING

All water and sewer improvements shall be tested in accordance with these Standards. All required tests must be arranged by the Developer and witnessed by the County, or its representative, to determine whether the facilities are constructed in accordance with the approved engineering plans and Standard Specifications. Developer will pay all costs of locating leaks and their repairs deemed necessary by the County as a result of said tests.

1.15 APPROVAL BY GOVERNMENTAL AGENCIES

The County's obligations are contingent upon Developer obtaining all necessary approvals for water and/or sewer system from all concerned governmental agencies. Developer assumes the risk of loss as a result of the denial or withdrawal of the approval of any concerned governmental agency, or caused by an act of any governmental agency which affects the ability of the County to provide water and/or sewer service to Developer not within the sole control of the County and which, by exercise of due diligence, the County is unable to overcome.

1.16 CONDITIONS PRECENDENT TO SYSTEM USAGE

Prior to the County accepting water and sewer system improvements, Developer shall comply with all terms of these Policies and Procedures and shall:

A. Provide to the County releases of liens received by the Developer, or its agent, in connection with the construction of the facilities.

B. Furnish the County with As-Builts as specified in Article 1.30.

C. Furnish, in form and substance acceptable to the County, all of the following relating to the facilities:

   1. All permits and governmental approvals obtained by the Developer, its contractors and agents.

   2. Certification by Developer’s engineer that the facilities have been constructed substantially in accordance with approved plans and specifications.

1.17 RIGHT OF TERMINATION OF SERVICE

The County shall refuse to provide service and reserves the right to terminate service to any lot or building within Developer’s property, in the event Developer defaults or fails to comply with any of the terms and conditions of these Policies and Procedures in a timely manner and fails to cure such default or fails to comply within 30 consecutive calendar days following the receipt by Developer of County’s notice of such default or failure to comply.

1.18 LIMITATION OF LIABILITY OF COUNTY

The County shall not be liable or responsible to the Developer as a result of injury to property or person, which injury was created by acts of God, strikes, lockouts, or other industrial disturbances, acts of public enemy, wars, blockades, riots, acts of armed forces, epidemics, delays by carriers, inability to obtain materials or right-of-way on reasonable terms, acts of public authorities, acts of vandals or other third parties, or any other causes whether or not of the same kind enumerated herein. In no event shall the County be liable to Developer or any customer for any consequential, incidental or punitive damages as a result of injury to property or person, regardless of whether said injury was the result of acts of or within the control of the County.

1.19 NO PROHIBITION OF FURTHER EXTENSION

These Policies and Procedures shall not prohibit or prevent the County from extending the County Water and Sewer Systems in or to other areas to serve other Developers or customers, so long as extensions and the furnishing of services do not interfere with the furnishing of the services to the Developer's establishment.

1.20 FINAL ACCEPTANCE BY COUNTY

Final acceptance of water and sewer system improvements by the County shall occur in writing before the signing of the final plat, at such time as Developer has met all of the terms and conditions of these Policies and Procedures. Maintenance bonds in the form of Letters of Credit will be issued by the developer to cover any costs of repairs for one year from the date of final plat signature by the BCWSS Director. Please refer to the specific sections to ensure that all requirements have been met before requesting acceptance. Final Plat procedures will be followed as described in the County UDC.

1.21 WARRANTY AND MAINTENANCE BONDS

A. The Developer shall be responsible for, and make any repairs or replacement required as the result of, any breakage, vandalism or other damage caused to the improvements until final acceptance by the County. After the final acceptance the Developer shall indemnify and hold County harmless from the cost of any repairs for any breakage or other damage to the improvements from time of completion of the improvements until completion of all buildings and houses, roads, paving, drainage, and other construction on Developer's property. If, within 10 days of the receipt of County notice of such breakage or other damage, the Developer fails to make timely repairs and corrections, the County shall have the option to make such repairs or replacements at Developer's cost.

B. Developer shall warrant water and wastewater system improvements and hold County harmless against all costs, expenses and losses, including, without limitation, incidental and consequential damages, resulting from any defects in the Developer's extension, including, without limitation, defects in material and workmanship, which are discovered or arise within a period of one year following

the date of the final acceptance. Developer shall provide a Maintenance Bond in form and substance acceptable to the County, in the amount of ten percent (10%) of the total cost of improvements.

1.22 TRUST INDENTURE

To assure continuity of maintenance and operation of non-County owned water and sewer systems, the Developer shall file a trust indenture or other legal contract or agreement with EPD for their review and approval. For new or proposed systems, the legal document shall be submitted with the plans and specifications in accordance with DNR Rules and Regulations for Safe Drinking Water (391-3-5) or Water Quality Control (391-3-6), as applicable. The County's participation in and supporting of any non-County owned utility system as trustee, is conditioned on:

A. The proposed water and/or sewer system being planned and designed is in accordance with these county standards and specifications.

B. A trust deed or other legal contract being prepared by the Developer(s) in form and content acceptable to the County.

C. All costs associated with preparation of plans and specifications (including reviews by the County or its designated representative) and the trust deed or legal contract, being borne by the Developer.

1.23 WASTEWATER TREATMENT PLANT CAPACITY

A. All requests for wastewater treatment capacity shall include a SANITARY SEWER EXTENSION SUBMITTAL form completed by a Registered Professional Engineer. A copy of this form has been included in the appendix of this document.

B. If available, written commitment of wastewater capacity will be provided to the Developer for a 12 (twelve) month period at the time of preliminary plat approval. If the Developer wishes to extend the capacity after 12 months, the Director must be informed at least 10 (ten) working days before the end of the 12 (twelve) month period is over and the capacity charge must be paid in full. If the capacity is not being utilized at any time after the 36 (thirty-six) month period expires, the County may choose to refund payment with no interest for any unused portion of capacity and said excess capacity will be revoked.

C. The reservation of wastewater treatment capacity will be limited to the actual number of ERU's committed by the County to the development.

1.24 MODIFICATION OF DEVELOPMENT PLANS

Should the Developer modify his development plans which would require greater water and/or sewage flows, or additional water and/or sewage facilities than the service demands designed and approved under the engineering plans and specifications, then Developer shall enter into a new agreement with the County providing for the construction of such additional water and/or sewer facilities meeting all County and governmental design requirements and shall pay all additional contributions and fees as may be required.

1.25 NOTICE OF CONNECTION TO COUNTY UTILITY SYSTEM

A. Developer shall notify BCWSS of connections to the water or sewer systems no less than 24 hours prior to said connection. If Developer fails to provide timely notice, the Developer will uncover and expose the connection for inspection.

B. Large Water Meter Connections: All persons desiring a two (2") or larger tap must make application at the BCWSS Office at least **seven (7)** working days prior to the date the tap is to be made. The contractor shall furnish the following information when making application:

1. Approved plan for the project.
2. Copy of Street or Highway Permit, if applicable.
3. Meter size and detector application, if for apartment, shopping center, etc.
4. Billing address and purchase order, if required.
5. Plan & Profile of meter installation, if two (2") or larger.

C. Water Main Connections for line extensions:

1. All Taps must be approved by the BCWSS.
2. BCWSS shall be notified four (4) working days prior to date of the tap on main line.
3. The Contractor will locate the main line valves on both sides of the tap on the main line.
4. Water system personnel shall supervise the service taps and associated work by private contractors.
5. All taps shall be made on wet lines.
6. All taps to be made with saddles or tapping sleeves.
7. Service taps on new mains shall be made wet.

1.26 INTERRUPTION OF FACILITY OPERATIONS

A. The Developer shall provide the County with written notice at least five days prior to any proposed interruption in facility operations required by construction activity. The notice shall include the date and time of the scheduled interruption; the length of time the interruption will be in effect; the procedures to be followed in effecting the interruption; a complete identification of all those equipment and operations to be affected; and all other information the County may require. The Developer shall provide all equipment, piping, auxiliary power or other means necessary to sustain facility operations or function for the planned interruptions.

B. The County must approve all proposed interruptions in facility operations. Such approval will be provided by the County to the Developer in writing.

C. The Developer shall conduct operations in a manner and sequence, which will provide for the continued transportation of water and/or wastewater flows during construction of the Developer's project. The Developer shall take all actions required to prevent discharge of sewer flow from the system to the ground or stream. Any construction actions that impede or interrupt flow shall be carefully executed and monitored to prevent surcharging of sewer systems and overflow.

D. Any damages resulting from sewer surcharging, overflow or back-up caused by the Developer's operations shall be the Developer's responsibility. Fines charged the County for overflows caused by the Developer shall be paid for by the Developer along with other damages resulting from the overflow and other damages.

1.27 APPLICATION FOR SERVICE

The Developer, his successors, or the occupant(s) of the developer's property, shall make written application to the County for the opening of an account(s) for service. At the time of making application for service, the applicant shall pay all connection fees and service charges as set forth in the current county code(s) establishing rates, charges and regulations. Refer to the current BCWSS rate and fee schedule for current commercial water and sewer deposits as approved by the Barrow County Board of Commissioners.

1.28 CONNECTION OF BUILDINGS (SEWER)

The Developer shall at his sole cost and expense connect the private property sewer pipes of each dwelling or other building constructed on Developer’s property to the sewer laterals of Developer’s extension as reflected in plans and specifications approved by the County.

1.29 NOTICE OF TRANSFER OF DEVELOPER'S PROPERTY (SEWER)

Developer agrees to provide proper written notice to County of the actual date of the legal transfer of sewer services from Developer to any third party. Developer shall remain responsible for all costs and expenses, including utility bills, which arise as a result of Developer’s failure to notify or improper notification to the County.

1.30 AS-BUILTS

A. As-builts shall be submitted in the following format:

1. Two (2) full size hard copies, and

2. Digital plans in AutoCad *DWG* format and pdf format.

B. Record Drawings shall be reproducible, shall have a title block indicating that the drawings are Record Drawings, the name of the company and PE preparing the Record Drawings, and the date the Record Drawings were prepared.

C. Legibly mark drawings to record actual construction, including:

1. All new construction in addition to the following

a. Changes of dimension and detail.

b. Changes made by Requests for Information (RFI), field order, clarification memorandums or by change order.

c. Details not on original Drawings.

d. Dimensions to each lateral connection from the downstream manhole.

2. Underground Utilities

a. Horizontal locations of all valves and other exposed facilities, referenced to permanent surface improvements. The locations shall be referenced to at least two easily identifiable, permanent landmarks (e.g., power poles, valve markers, etc.) or benchmarks.

b. Location of and dimensions of roadways and parking areas, providing dimensions to back of curb when present.

c. For sewers, the Record Drawings shall include the plans and profiles displaying the state plane coordinates of each manhole, the distance between manhole covers, the depth and inverts of each manhole, the slope of the sewer line, and the stationing of the sewer laterals.

d. For force mains, the profile of the top of the pipe shall be provided. Elevations, not depths, shall be provided at air valves, low points, and any other locations deemed necessary by BCWSS.

3. Pumping Stations

An overhead view of the layout of all components of the pumping station. Including vaults, valves, bypass pumps, etc. As approved by BCWSS.

D. Precision

1. Unless noted otherwise, Record Drawings shall provide horizontal dimensions, distances and coordinates to the nearest 0.1-foot.

2. Unless noted otherwise, Record Drawings shall provide elevations to the nearest 0.01-foot for all pertinent items constructed by the Contractor.

3. For gravity sewers, the Contractor shall employ a currently registered surveyor to prepare the Record Drawings from a post construction, field run survey. The Record Drawings shall provide elevations to the nearest 0.01-foot for all manhole inverts, manhole frames and other pertinent items constructed by the Contractor.

E. The cover of the Record Drawings shall include the following information:

1. Name, business address, telephone number, license number of the Contractor and 24 hour contact person.

2. Name of manufacturer and supplier of pipe, valves, hydrants, precast manholes and other applicable water/sewer products provided on the project.

2. Acceptance date by County.

3. (For sanitary sewer projects) The following statement signed by the engineer of record: "I hereby state that, based on the lines and grades of the as-built survey and my personal inspection during construction, the lengths and slopes of the gravity sewer as shown on these record drawings comply with BCWSS standards and specifications."

4. (For water projects) The following statement signed by the engineer of record: "I hereby state that, based on the red lined drawings supplied by the contractor and my personal inspections during construction, the horizontal location of the waterline and of all valves and hydrants as shown on these record drawings complies with BCWSS standards and specifications."

5. All as-builts must be signed by the P.E.

F. Video Inspection (Gravity Sewers)

1. An electronic copy of the inspection video shall be provided to the County before the sewer system can be accepted.

2. The video shall record the footage as the camera progresses through the sewer line. The location of each lateral shall be shown clearly on the video by both lot number and linear footage from the manhole.

3. A field report of the video inspection shall be submitted to the County to include the following:

   a. A diagram for each gravity sewer segment between manholes on a separate 8 ½ x 11 sheet.

   b. The direction of flow for that segment of pipe.

   c. The linear footage to each sewer lateral as measured from the same referenced manhole.

   d. The linear footage to each sewer lateral as measured from the same referenced manhole.

END OF SECTION

SECTION 1.2 - WATER SYSTEM DESIGN REQUIREMENTS

2.01 GENERAL

The Developer shall be responsible for the design of an adequate water distribution system and/or treatment facilities where necessary. The methods of design and construction shall be in accordance with all County codes, accepted engineering practices, BCWSS standard specifications and details and this Section. Water systems shall be located entirely within County-owned property, rights-of-way or dedicated easements.

2.02 DESIGN WATER DEMAND

A. Average Daily Demand for Residential, Single-Family and Multi-Family: In the absence of data to the contrary, the following shall be used:

1. 110 gallons per capita per day (gpcd)

2. 385 gallons per day (GPD) per connection

3. Fire flow shall equal or exceed 500 gallons per minute (gpm) for residential and 1,000 gpm for commercial and industrial areas. There shall be a minimum residual pressure of 20 pounds per square inch - gage (psig) with full fire flow and design peak hour flow demands acting simultaneously, or as required by the Fire Marshal in accordance with current International Fire Code. Fire flow shall be obtained by utilizing correct pipe sizing. The use of booster pump stations is prohibited.

B. All Others: Actual flow or estimate for each individual case as approved by BCWSS.

C. Design Peak Water Demand:

Flow Condition	Gallons-per-minute
Peak Day	1.8 x (no. of connection) x 0.3
Peak Hour	3.25 x (no. of connections) x 0.3

D. All fire service water mains shall comply with current International Fire Code requirements or as approved by the County Fire Marshall.

E. System Looping:

1. Water plans will be reviewed for potential looping within the system to provide reliable service and adequate fire protection for the sub-division as detailed in AWWA Manual M31.

2. In the event a line is not looped and where valves and plugs are installed for future expansion, measures shall be taken to prevent stagnant water from developing in the water main.

2.03 SIZES OF WATER MAINS

A. Mains shall be 8-inch minimum nominal diameter pipe. A 6-inch nominal diameter pipe may be used on lines serving cul-de-sac streets extending 200 linear feet or less where approved by BCWSS.

B. House service connections shall be 3/4-inch pipe, minimum.

2.04 LOCATION

A. Water Mains: Shall be located within right-of-way of street or easement.

B. Easements: Minimum 20-feet width for water main. Easements will be allowed only when there is no other way to service development.

C. Elevated Water Storage Tanks: Located outside of street or easement right-of-way on a parcel of land no smaller than 1 acre.

D. Pipeline Depth: Water Mains shall be designed to meet the following depth requirements:

1. Minimum four feet of cover.

2. Top of pipe shall be two feet below any creek, stream or ditch for all crossings and parallel installations.

E. Fire hydrants:

1. Generally locate at intervals not to exceed 500 feet unless prior approval is received from the County Fire Marshal and BCWSS in accordance with current International Fire Code.

2. Fire hydrants shall be located within five feet of the nearest property corner, unless otherwise approved by BCWSS.

3. Fire hydrants within commercial and industrial developments must be located so that all planned structures are within 300 feet of a fire hydrant.

F. Valves shall be installed at each intersection or connection point, and in no case shall spacing exceed 2,000 linear feet. In addition, valves shall be spaced no greater than 1,000 linear feet within a residential subdivision.

G. Proximity to Sewer Lines:

1. There should be no physical connections between a public or private potable water supply system and a sewer, or appurtenances, which would permit the passage of any sewage or polluted water into the potable supply. No water pipes shall pass through or contact any part of a sewer manhole.

2. Water mains shall maintain a minimum of 10 feet edge-to-edge horizontal separation from sewer lines, whether gravity or pressure. In cases where the main cannot be installed within the prescribed easement or right-of-way and maintain 10 feet separation, BCWSS may reduce this distance provided that the water main be placed in a separate trench or undisturbed earth shelf.

3. Where water lines cross or are installed parallel to sewer lines, a minimum of 18-inches of vertical separation between the bottom of the water main and the top of the sewer is required.

4. When neither of the horizontal or vertical separation criteria is possible, the water main shall be installed below the sewer with a minimum vertical separation of 18-inches. The water main, when installed below the sewer, shall be encased either in a watertight casing pipe or in concrete with a minimum 6-inch concrete depth to the first joint in each direction. The encasement shall extend 10 feet on both sides of the crossing. Where water mains cross the sewer, one full length of water pipe shall be located so that both joints will be as far from the sewer as possible.

2.05 SERVICE CONNECTIONS

A. All service connections shall be 3/4-inch minimum size with a separate service connection to each lot located at property corners or as directed by BCWSS.

B. The Developer shall install an appropriate backflow prevention device as approved by BCWSS and the Georgia Plumbing Code on all service connections including fire suppression systems.

C. A service connection marker shall be placed at all service connections. The marker shall be a white, 2-inch diameter, PVC pipe with the top 6-inches painted blue. The service connection markers shall stand approximately 4- feet above grade. These markers may not be removed until after final grading is complete and sod is installed. The water meter lid shall not be covered at any time with sod, dirt, or any other landscaping material. The water meter lid shall be left visible at all times.

D. All water meter boxes shall be even with ground surface and any correction fees shall be paid before the Certificate of Occupancy will be issued.

2.06 MATERIALS OF CONSTRUCTION

A. Residential Subdivisions: All water mains 10-inches and larger in diameter shall be constructed of ductile iron pipe. Water mains 8-inches and smaller in diameter may be constructed of ductile iron or C-900 PVC pipe.

B. All water mains in commercial areas, on private easements, or along major county roadways shall be constructed of ductile iron.

C. In locations where the water main may be exposed to non-routine installation conditions, the main shall be constructed using ductile iron pipe. These conditions include, but are not limited to:

1. Where depth of cover is less than four feet or greater than fourteen feet;

2. Where water main is installed under pavement;

3. Where water main crosses over a storm drain pipe;

4. Where water main crosses under a creek or stream;

5. Where water main crosses over or under a sewer main;

6. Along State and County road rights-of-way;

7. Other locations deemed necessary by the BCWSS.

D. Appropriate protective measures shall be utilized when installing ductile iron pipe in aggressive soils or other potentially corrosive environments.

END OF SECTION

SECTION 1.3 - WASTEWATER SYSTEM DESIGN REQUIREMENTS

3.01 GENERAL

The Developer shall be responsible for the design of an adequate sanitary sewage collection system. The methods of design and construction shall be in accordance with all county codes, accepted engineering practices, and this Section. Sewer systems shall be located entirely within County-owned property, rights-of-way or dedicated easements.

3.02 DESIGN FLOWS AND LOADING

A. Average Daily Residential Flow Rates, Single-Family and Multi-Family: In the absence of data to the contrary, the following shall be used:

1. 85 gpcd

2. 220 GPD per connection

B. All Others: Actual flow or estimated for each individual case as approved by the County.

C. Design Wastewater Peak Flow Factor:

1. Residential projects, including pump stations, shall be 2.5 times the average flow rate.

2. Commercial Projects: The designer shall consult with the County for determination of the peak factor for each project on a case-by-case basis. unless otherwise approved by BCWSS.

D. Peak Flow Design:

1. Sewers that are 15-inches in diameter and smaller are to carry peak design flow when flowing at 50% full (no hydraulic head allowed).

2. Sewers that are larger than 15-inches in diameter are to carry peak design flow when flowing at 75% full (no hydraulic head allowed).

3.03 DESIGN PERIOD

The minimum design period for sewage collection and treatment facilities shall be as follows:

A. Gravity Sewers: 25 years

B. Force Mains: 20 years

C. Pumping Stations: 20 years

D. Treatment Facilities: 20 years

3.04 HYDRAULIC DESIGN

A. Mains, submains and lateral sewers, 8-inch pipe, minimum; actual as based on hydraulic computations.

B. House service connection, 6-inch pipe minimum; from main to right-of-way clean out.

C. When increasing size of gravity sewer piping, pipe crowns shall be matched at manholes.

D. Force Mains:

1. 4-inch pipe, minimum; nominal. 3-inch pipe, nominal may be allowed for small pump stations on a case-by-case basis.

2. Manifolding with new or existing force mains is not allowed.

3.05 LOCATION

A. Gravity Sewers: On centerline of street or easement.

B. Force Mains:

1. Outside of Pavement: In a 10 foot easement outside and adjacent to the right-of-way and on opposite side of street or easement from water main.

2. Along County or DOT Roads: Force main may be designed in right-of-way.

C. Easements: Minimum 20-foot width for sewer or force main. Easements will be allowed only when there is no other way to service development.

E. Proximity to Water Mains:

1. There should be no physical connections between a sewer and a public or private potable water supply system, or appurtenances, which would permit the passage of any sewage or polluted water into the potable supply. No water pipes shall pass through or contact any part of a sewer manhole.

2. Sewer mains, whether gravity or pressure, shall maintain a minimum of 10 feet edge-to-edge horizontal separation from all potable water mains. In cases where the main cannot be installed within the prescribed easement or right-of-way and maintain 10 feet horizontal separation, BCWSS may reduce this distance provided the water main is above the sewer in a separate trench or an undisturbed earth shelf.

3. Where sewer mains cross or are installed parallel to potable water lines, a minimum of 18 inches of vertical separation between the bottom of the water main to the top of the sewer is required.

4. In cases where the sewer main must be installed within the minimum horizontal separation, or vertical separation below the potable water main, or cross above the potable water main; the sewer main shall be encased either in a watertight casing pipe or in concrete, which extends 10 feet on both sides of the crossing.

F. Pipeline Depth:

1. Gravity sewers shall be designed to meet the following depth requirements:

   a. Minimum of four (4) feet of cover from the top of the pipe.

   b. Such a depth as to allow service connections to be constructed at minimum 2.0 percent slope from sewer to probable house location on each lot to be served and assuming service line is three (3) feet deep at probable house location.

2. Force mains shall be designed and constructed with a minimum of four (4) feet of cover from the top of the pipe. Grade and depth of cover shall be adjusted as needed to minimize the number of high points on the force main as well as to maintain a positive grade upstream and negative grade downstream of each high point.

3. Top of pipe for gravity sewers and force mains shall be:

   a. Two (2) feet below any creek, stream or ditch when such is crossed.

   b. Two (2) feet below any adjacent creek, stream or ditch.

4. Depth of cover less than four (4) feet from the top of the pipe may be allowed on a case-by-case basis. Gravity sewers and force mains installed with less than four feet of cover shall be ductile iron pipe with a corrosion-resistant lining in accordance with the County standard specifications.

G. Gravity sewers and force mains shall be installed in steel casing at all creek, stream and ditch crossings, highway and railroad crossings and other applications as required by the County in accordance with County standard specifications and details.

H. Aerial Crossings: Aerial crossings for gravity sewers are not permitted unless approved by BCWSS. Specific design criteria shall be evaluated on an individual basis by BCWSS.

3.06 SERVICE CONNECTIONS

A. All service connections shall be 6-inch minimum size with a separate service connection to each lot. The maximum allowable length for a residential service connection or commercial lateral is 250 LF.

B. Services shall connect to the existing sewers at manholes instead of direct connections to the sewer pipe, unless otherwise approved by BCWSS. Service connections are not permitted to directly penetrate 24-inch diameter or larger trunk sewers, unless otherwise approved by BCWSS.

C. Inline manhole service connections shall be limited to two, one from each side of the street. Invert of service connection shall be installed at an elevation not greater than two feet above the invert of the sewer main. A maximum of three may be installed in any terminal manhole, if the crown of the service connection and the lateral sewer line are at the same elevation.

D. Vertical service connection risers are not permitted within street rights-of-way.

E. Clean-outs are not permitted within street rights-of-way, except for service laterals. In such case the clean-out shall be located at the right-of-way line.

3.07 VELOCITIES

A. Gravity Sewers: When flow is one-half full, minimum velocity shall be 2.0 feet per second. Maximum velocity for any gravity sewer shall not exceed 10.0 feet per second under all conditions.

B. Force Mains: Minimum velocity shall be 3.0 feet per second; maximum velocity shall be 6.0 feet per second.

3.08 GRAVITY SEWER PIPE SLOPE

A. Minimum slopes for gravity sewer lines shall be as follows:

Diameter, Inches	Min. Slopes, %*
8	0.70
10	0.50
12	0.40
15	0.30
16	0.30
18	0.25
21	0.20
24	0.15

* Unless otherwise approved.

B. Maximum pipe slope shall not exceed 15%.

3.09 SEWER STRUCTURAL INTEGRITY

A. In locations where the sanitary sewer may be exposed to non-routine installation conditions, gravity sewers and force mains shall be protected with a steel casing or be ductile iron pipe. These conditions include, but are not limited to:

1. Where depth of cover is less than four feet or greater than fourteen feet.
2. Where sewer crosses over or under a storm drain pipe.
3. Where sewer crosses under a creek, stream or ditch.
4. Where sewer crosses over or under a water main.
5. Other locations deemed necessary by the County.

B. All ductile iron pipe and fittings used for gravity sewers and force mains shall be lined with a corrosion-resistant material in accordance with Section 4.1, Item 2.01.D of the County standard specifications.

3.10 MANHOLES

A. Location: Provide manholes at all changes in pipe grade, pipe size, alignment, intersections, and at the end of a pipe run.

B. Provide manholes at intervals not to exceed 400 linear feet.

C. A minimum drop of 0.2 feet shall be provided between manhole inlet and outlet pipes.

D. An outside drop pipe shall be provided at manholes where the influent sewer enters the manhole at a height of two feet or greater above the invert elevation of the outgoing pipe.

E. Sampling Manholes:

1. Grease Traps - Grease traps used for commercial establishments shall include a sampling manhole on the grease trap effluent line prior to discharge into the County sewer system. The invert elevation of the line entering the sampling manhole shall be no less than 6-inches higher (2-feet maximum) than the manhole invert to facilitate collection of a sample.

2. Industrial Users - In order to provide for accurate sampling and measurement of industrial wastes, each significant industrial user shall provide and maintain, on each of its industrial waste outlet sewers, a monitoring station to be located outside the plant. If specified manhole is inside the plant fence, there shall be a gate near the sampling manhole with a key furnished to the County. There shall be ample room provided in each monitoring station to enable convenient inspection and sampling by the County, or its agent. The invert elevation of the incoming sewer shall be no less than 6-inches higher (2-feet maximum) than the manhole invert to facilitate the collection of a sample. Also, a parshall flume and a 110 volt electrical outlet may be required to allow for composite sampling. In certain monitoring stations where noxious fumes may accumulate, the County may require a fume exhaust system to protect the life and health of the County employees who are required to enter the monitoring station. The fume exhaust system shall extract the fumes from the bottom of the station and provided no less than one complete air exchange per minute.

F. Force Main Discharge: Inlet piping to manholes on gravity sewers receiving force main discharges shall be in accordance with the County standard specifications and details. The receiving manhole and next two downstream manholes on the gravity sewer shall be coated with a corrosion-resistant material in accordance with County standard specifications.

G. Manholes of 5 feet in diameter or larger shall be required on all gravity sewer lines greater than 14 feet in depth with grade elevation.

3.11 AIR RELEASE/AIR VACUUM VALVES

An air release/air vacuum valve (ARV) shall be installed at each high point on force mains. Location and sizing of ARV's shall be determined by hydraulic modeling of the force main. Each ARV installation shall include an inline plug valve immediately upstream of the ARV.

3.12 GREASE TRAPS

A. Grease, oil, flammable liquid, and/or sand traps shall be provided at all vehicle service stations, commercial or industrial food-handling establishments, and at any other commercial or industrial establishment or public or municipal institutions, such as schools, hospitals and prisons, at which such devices are necessary for the proper handling of liquid wastes containing grease, oil, flammable liquids, or sand.

B. Grease traps shall not receive flows from sanitary facilities (e.g., toilets, showers and hand-washing sinks), storm drainage, sump pumps and garbage grinder discharges.

C. Such grease traps shall be of a type and size approved by the County and shall be located as to be readily and easily accessible for cleaning and inspection by County personnel.

D. Such grease traps shall be properly maintained by the sewer service customer. Maintenance shall include periodic removal of the contents of the grease trap with no reintroduction of any portion of the waste into the grease trap or introduction into the County's sewer system. The County may require grease trap maintenance based upon the observation of material build-up in the grease trap.

E. Food-handling establishments with no inside cooking may install an inside/under-the-counter type grease trap. All other establishments where grease traps are required shall install an outside grease trap with a capacity of at least 1,500 gallons. A variance for a smaller-sized grease trap may be granted in accordance with the County's Sewer Use Ordinance.

3.13 ENVIRONMENTAL IMPACTS

All components of the sanitary sewage system shall be designed to minimize impacts on the environment. This includes taking into consideration the proximity of impounded water, rivers, streams, wetlands, the contours of the land and the construction's impact on soil erosion and sedimentation. Soil erosion and sedimentation control devices shall be designed for a 25-year storm event.

END OF SECTION

SECTION 1.4 - WASTEWATER PUMPING STATION DESIGN REQUIREMENTS

4.01 GENERAL

A. Pumping stations to be dedicated to the County will be considered on an individual basis. It is the Developer's responsibility to contact BCWSS early in the planning stage for direction. Private pumping stations shall be designed, permitted, and constructed in coordination with BCWSS.

B. Wastewater pumping stations shall normally be duplex, submersible type. Other configurations may be approved if necessary as determined by conditions of design and after completion of engineering analyses.

C. Station design and construction shall be in accordance with County standard specifications and details and items 4.02 - 4.07 of this Section.

D. Pumping stations shall be designed to consider future upgrades or modifications necessary to address planned increases in station influent due to expansion of the station's service area or other factors.

E. Pumping stations shall be designed to allow adequate access to the facilities by County maintenance personnel, including movement of service vehicles, mowing needs, gate clearances, etc.

F. Pumps shall be manufactured by Xylem Water Solutions USA, Inc. Flygt Products referred herein as Flygt. Alternative manufacturers may be considered on a case-by-case basis if approved in advance by BCWSS.

G. The pumping station must be 100 percent complete and signed off as such by BCWSS inspectors prior to scheduling a start-up. As-builts, O&M manuals (two copies), and any required spare parts must be submitted to the BCWSS representative at the time of start-up. A minimum of two (2) weeks notice shall be required for all start-ups.

H. The developer shall consult with BCWSS during the design of the system. The system shall be designed with all components sized to meet the development’s average daily flows (i.e., approved capacity) adjusted for peaks. The developer may elect to size the system to meet future phases of the project or may upgrade the system at a later date to serve additional phases. Any such upgraded capacity shall be reserved for the developer (subject to availability of treatment capacity) for a period of three (3) years from the date of start-up. The reserved capacity shall only include the number of lots or commercial flow quantity as identified on plan submittals approved by BCWSS. The difference between the development’s projected flow and the actual pump flow is not to be considered as capacity belonging to the developer. Any such “extra” capacity beyond that reserved for

the original developer becomes available for BCWSS to utilize at its discretion. The developer may relinquish his reserved pumping capacity at any time by notifying BCWSS in writing.

I. Odor control shall be provided where directed by BCWSS.

4.02 PUMPING SYSTEM EQUIPMENT AND APPURTENANCES

A. Pumps shall be wet well mounted, nonclog designed for submerged service in wastewater containing solids in accordance with County standard specifications. The pump shall be complete with motors, permanently-fixed discharge elbow, guide rails, upper and lower guide brackets, power cables, lifting chains, pump controls, level sensors and all bolts, spare parts and other accessories needed for a complete installation.

B. All nuts, bolts, fasteners and other hardware coming in contact with sewage shall be 316 stainless steel construction.

C. Emergency Back-up:

1. Each station shall be equipped with a permanently mounted, diesel powered bypass pump capable of sustaining operation of the pumping station in case of power outage or mechanical failure of the submersible pump system.

2. The bypass pump shall have a capacity at least equal to one of the station's submersible pumps and be capable of automatic operation utilizing float switches separate from the level control system used for the submersible pumps.

3. The bypass pump shall be equipped with an electric or photovoltaic battery charging system.

4. A spare starter shall be provided at start-up.

5. The bypass pump shall be a Godwin model manufactured by Xylem Water Solutions USA, Inc. BCWSS may consider alternative manufacturers on a case-by-case basis.

6. In areas where natural gas service is available, BCWSS may accept a natural gas powered engine in lieu of a diesel engine.

D. Controls: Controls shall be as required for "lead-lag" operation based on wet well water levels in accordance with the County standard specifications and details and be in conformance with manufacturer recommendations.

E. Piping: All exposed piping within the wet well and valve vault and used for above-grade connections (e.g., bypass pump suction and discharge lines) shall be ductile iron pipe with corrosion resistant liner in accordance with the County standards and specifications and details. Exterior of piping inside wet well shall be coated in accordance with County standards and specifications and details.

F. Valves: Shall include a check valve and plug valve on each pump discharge line to include the emergency bypass pump in accordance with the County standards and specifications and details. A surge relief valve on the force main just downstream of the valve vault and discharging back to the wet well may be required for high head applications.

G. Yard Hydrant: A frost-proof yard hydrant with 50' of ¾" nylon reinforced garden hose with brass nozzle shall be installed within the pump station fencing. A County water service connection to the yard hydrant shall be provided including an BCWSS approved water meter and reduced pressure zone backflow prevention device (RPZD).

H. The following ancillary components shall be provided:

1. Spare parts:
    a. One (1) phase monitor
    b. One (1) pump impeller
    c. One (1) soft start motor starter (if used)
    d. One (1) starter for bypass pump
    e. Two (2) of each fuse used at the station
2. Multi Smart Controller with Level sensor probe
3. GasAlertQuattro4 combustible gas detector and calibration kit manufactured by BW Technology or approved equal
4. Audible alarm with silencer
5. Visual alarm
6. Pressure gauges with wastewater diaphragm seals on all discharge piping inside vault
7. Site lighting on a lighting service pole
8. Elapsed time meter and start counter (each pump)
9. Metered water service connection
10. An approved auto-dialer with one (1) direct connect high level float for bypass pump

4.03 PUMP SELECTION

A. Pump selection shall consider full operating range; including shut off, duty point, and run out.

B. Pump cycle times shall be configured so as to prevent septic conditions. Odor control equipment may be required by BCWSS where necessary.

C. Pump efficiency shall not be less than 50%, unless otherwise approved by BCWSS.

D. Pumps shall be designed to pump to the final high point (i.e., the hydraulic high point) of the force main route, whether that is the discharge manhole or another point on the force main route. Force mains will not be approved to flow downhill into the receiving manhole. After the proposed force main passes over the last high point along its route a new gravity sewer line must be installed to convey the flow downhill to the existing sewer system. Pumps selected shall not have a flat curve and Motor HP rating shall exceed the HP draw over the range of operating conditions of the pump. Exceptions to this requirement may be granted on a case by case basis if in the opinion of BCWSS there is no benefit to the County for having gravity sewer in the particular location involved.

4.04 WET WELLS AND VALVE VAULTS

A. Design: Wet wells and valve vaults shall be designed to counteract buoyancy forces during high ground water and/or flood conditions. Wet wells must be designed with 25% additional hydraulic storage capacity than anticipated.

B. Only one influent pipe into the wet well will be permitted.

C. Construction: Precast reinforced concrete in accordance with County standard specifications and details.

D. Corrosion Resistant Coating: A corrosion resistant coating shall be applied to all interior surfaces within each precast concrete wet well structure. Coatings shall be field applied in accordance with the manufacturer’s recommendations, by qualified and experienced personnel. Coatings shall be in accordance with the County standard specifications.

E. Access Hatch: A metal access hatch shall be installed in the wet well top. A minimum opening of 48" x 48" shall be provided, but the hatch shall be sized with enough clearance to lift pumps straight our of the wet well. All hatches shall have metal safety grates.

F. Vent: Wet wells require a vent pipe.

G. Wet well shall be sized such that the pump does not start more than once every ten minutes.

H. High Water Level Alarms: High water alarm(s) within the wet well shall meet the following two criteria:

1. A minimum of five feet below the lowest floor slab of all houses, apartments, buildings, businesses, etc. being served as well as five feet below wet well top.

2. Below the lowest sewer invert connected to the wet well.

4.05 SECURITY FENCE

The pumping station facilities shall be enclosed within a 6-ft high chain link security fence in accordance with the County standard specifications and details.

4.06 PUMP STATION SITE

A. Provide a driveway, turnaround area and parking facility for maintenance vehicles. The driveway, turnaround and parking areas shall be constructed with Size No. 4 crushed stone with a minimum depth of 6-inches. The turnaround area shall be a minimum of 20 feet deep by 12 feet wide if located outside of the pump station fence. The pump station fenced area may be increased in size from the minimum requirements of Article 4.05.B below to incorporate the turnaround inside the fenced area upon approval by the County or its designated representative.

B. The pump station fenced area shall be a minimum 40 feet wide by 50 feet deep. If a surge relief valve is required, the minimum fenced area shall be 40 feet wide by 60 feet deep.

C. The pump station graded pad area shall extend a minimum 1 foot outside the fenced area. Size No. 4 stone shall be placed over the entire graded pad area, including the area outside the fence.

D. The pump station easement shall extend a minimum of 5 feet outside the pump station fenced area on all sides or a minimum of 2 feet from the base of the slope of the graded pump station pad on all sides, whichever is greater.

4.07 LANDSCAPING

Landscaping must utilize low maintenance vegetation. The type of vegetation is to conform to the development in type and size of vegetation. BCWSS must pre-approve all landscaping plans. Landscaping must incorporate evergreen shrubs and trees such as leyland cypress, holly bushes, wax myrtle or other types of plants deemed appropriate by landscape architect.

END OF SECTION

SECTION 1.5 - APPLICABLE WATER AND WASTEWATER STANDARDS

5.01 STANDARDS

It is intended that the Developer and/or Owner be responsible for the design of adequate water and wastewater systems as necessary for the development being served. The methods of design and construction shall be governed by the applicable standards listed hereinafter. By reference, the standards are made a part of these specifications and standards.

A. Georgia State Department of Natural Resources (DNR), Environmental Protection Division (EPD), Rules and Regulations for Water Quality Control, Chapter 391-3-6, latest effective date, Drinking Water Rules 391-3-5, latest effective date.

B. Water Environment Federation (WEF), Regulation of Sewer Use, WEF Manual of Practice No. 3, latest edition.

C. Recommended Standards for Wastewater Facilities, 2014 or later editions, Policies for the Review and Approval of Plans and Specifications for Wastewater Facilities, A report of the Committee of the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers, generally referred to as the "Ten (10) States Standards for Sewage Works".

D. Gravity Sanitary Sewer Design and Construction, American Society of Civil Engineers (ASCE) Manuals and Reports on Engineering Practice No. 60, Water Environment Federal (WEF) Manual of Practice No.FD-5, revised April 1982.

E. Utility Accommodations Policy and Standards, Georgia Department of Transportation, Office of Utilities, latest edition.

F. Soils Survey of Barrow County, Georgia, by the United States Department of Agriculture, Soil Conservation Service, in cooperation with the University of Georgia College of Agriculture, Agriculture Experiment Stations.

G. American Water Works Association (AWWA) Standards, latest editions.

H. American National Standards Institute (ANSI) Standards, latest editions.

I. American Society for Testing and Materials (ASTM) Standards, latest editions.

J. Occupational Safety and Health Administration (OSHA) regulations, latest editions.

K. Georgia Department of Transportation (DOT) specifications and regulations, latest editions.

L. American Association of State Highway and Transportation Officials (AASHTO) specifications, latest editions.

M. American Society of Mechanical Engineers (ASME) standards, latest editions.

N. National Electrical Manufacturer's Association (NEMA) standards, latest editions.

O. American Concrete Institute (ACI) standards, latest editions.

P. American Welding Society (AWS) standards, latest editions.

Q. Manual on Uniform Traffic Control Devices (MUTCD), Latest Edition

R. Manual for Erosion, Sediment and Pollution Control in Georgia, Latest Edition

S. Barrow County Unified Development Code, Latest Revision

T. International Fire Code, Latest Edition

END OF SECTION

END OF ARTICLE 1

ARTICLE 2
SITE WORK

SECTION 2.1 - SAFETY IN WATER AND WASTEWATER WORKS

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall be responsible for conducting all Work in a safe manner and shall take reasonable precautions to ensure the safety and protection of workers, property and the general public.

B. All construction shall be conducted in accordance with the latest applicable requirements for Part 1926 of the Occupational Safety and Health Act, Safety and Health Regulations for Construction, Section-107 of the Contract Work Hours and Safety Standards Act, as well as any other local, state or federal safety codes and regulations.

C. The Contractor shall designate a trained and qualified employee who is to be responsible for ensuring that the Work is performed safely and in conformance with all applicable regulations.

D. The Contractor shall determine the safety hazards involved in prosecuting the Work and the precautions necessary to conduct the Work safely.

E. The Contractor shall bear all risks associated with performing the Work and shall fully indemnify and hold harmless the Owner and Engineer.

1.02 SPECIAL REQUIREMENTS

A. The Contractor's attention is directed to the fact that construction activities involving potable water and sanitary sewer systems will occasionally involve work in potentially hazardous environments in which oxygen deficient, toxic or explosive conditions may exist. Additional hazards arise from the presence of pathogens in the wastewater and from the slime and scum layer that coat walking, working and-other surfaces. In dealing with these hazards, the Contractor shall take special precautions to ensure worker safety. Such precautions shall include, but are not limited to, the following, as applicable:

1. Installing temporary forced air ventilation equipment and ducts for fresh air in enclosed areas.

2. Using pneumatic tools and equipment instead of electric-driven equipment in hazardous areas.

3. Avoiding the use of cutting torches, field welding and grinders in hazardous areas.

4. Cleaning and disinfecting working surfaces with hot water, high, pressure washers prior to commencing work.

5. Installing sealed wooden baffles or bulkheads to isolate working areas from hazardous atmospheres.

6. Providing portable oxygen meters, combustible gas detectors and hydrogen sulfide detectors to continuously monitor the atmosphere in enclosed working areas.

7. Providing safety harnesses, safety lines and recovery crews for workers in hazardous areas.

8. Providing self-contained breathing apparatus with spare air cylinders for workers in hazardous areas.

9. Providing dry chemical fire extinguishers and connected fire hoses in areas where a danger of fire or explosion exists.

10. Providing adequate, oxygen-equipped, first aid facilities.

11. Providing suitable wash-up areas and facilities for workers.

12. Installing temporary lighting using explosion-proof fixtures in hazardous environments.

13. Installing approved warning and hazard signs and posting safety procedures.

14. Instructing all workers as to the hazards present, the procedures to be followed and the proper function and use of all safety and emergency equipment furnished.

B. Prior to commencing Work on existing facilities and equipment, the Contractor shall notify the County and shall ensure that the source of electrical energy to all affected equipment is shut off and locked out at the appropriate motor control center. Local switches and pushbutton stations, where provided, shall be locked in the "off" position.

C. Prior to entering or commencing work in a hazardous area, the Contractor shall ensure that all safety and emergency equipment is in place and in satisfactory operating condition.

END OF SECTION

SECTION 2.2 - CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SCOPE

A. Clearing and grubbing includes, but is not limited to, removing from the Project site, 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. Precautionary measures that prevent damage to existing features to remain are part of the Work.

B. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion and sedimentation control procedures.

1.02 QUALITY ASSURANCE

A. The Contractor shall comply with all applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction over the Project. All required permits of a temporary nature shall be obtained for construction operations by the Contractor.

B. Open burning, if allowed, shall first be permitted by the local authority having jurisdiction. The Contractor shall notify the local fire department and abide by fire department restrictions.

1.03 JOB CONDITIONS

Location of the Work: The area to be cleared and grubbed shall be shown schematically on the Drawings and include all areas designated for construction.

1.04 PROJECT ACCESS

Where private property is used for access to the Project site, the Contractor shall obtain written permission for such access from the affected private property owners. The Contractor shall be solely responsible for all damage caused by access through the private property.

PART 2 PRODUCTS

2.01 EQUIPMENT

The Contractor shall furnish equipment of the type normally used in clearing and grubbing operations including, but not limited to, tractors, trucks, loaders, root rakes and burning equipment.

PART 3 EXECUTION

3.01 SCHEDULING OF CLEARING

A. The Contractor shall clear at each construction site only that length of the right-of-way, permanent or construction easement which would be the equivalent of one month's pipe laying.

B. The County may permit clearing for additional lengths of the pipe line provided that temporary erosion and sedimentation controls are in place and a satisfactory stand of temporary grass is established.

3.02 CLEARING AND GRUBBING

A. Clear and grub along the pipeline route before excavating. Remove all trees, growth, debris, stumps and other objectionable matter. Clear the construction easement or road right-of-way only if necessary.

B. 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 will not be required.

C. 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.

D. Landscaping features shall include, but are not necessarily limited to, fences, cultivated trees, cultivated shrubbery, property corners, man-made improvements, subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features.

E. Surface rocks and boulders shall be grubbed from the soil and removed from the site if not suitable as rip rap.

F. Where tree limbs interfere with utility wires, or where 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.

G. 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 by the contractor. Any fencing that, in the County’s opinion, is significantly damaged shall be replaced by the contractor with new fence material.

H. The Contractor shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, etc. situated within the limits

of the construction area but not directly within excavation and/or fill limits. The Contractor shall be held liable for any damage the Contractor's operations have inflicted on such property.

I. The Contractor shall be responsible for all damages to existing improvements resulting from Contractor's operations.

3.03 DISPOSAL OF DEBRIS

A. 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, shoved onto abutting private properties or buried on the Project.

B. When approved in writing by the County, the Contractor may dispose of such debris by burning on the Project site. The authorization to burn shall not relieve the Contractor in any way from damages which may result from Contractor's operations. On easements through private property, the Contractor shall not burn on the site unless written permission is also secured from the property owner, in addition to authorization from the County.

END OF SECTION

SECTION 2.3 - SOIL EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SCOPE

A. Submittals and Permits

1. The Developer shall acquire Land Disturbance Permits from the appropriate authority and shall pay any fees for said permits. The Developer shall be responsible for submitting to the appropriate authority sufficient documents such that the authority can acquire approval from the local Soil and Water Conservation District. All fines imposed for improper erosion and sedimentation control shall be paid by the Developer. See the Barrow County Soil Erosion and Sediment Control Ordinance.

2. Land disturbance activity shall not commence until the Land Disturbance Permit is issued.

3. Working drawings shall indicate controls which will ensure that storm water and drainage from the disturbed jobsite areas, which will be denuded, stripped or modified of its naturally existing or artificially established stabilization or protection against erosion, shall pass through some type of filter system before being discharged. These areas shall be kept sufficiently moist to control dust.

B. Basic Principles:

1. All erosion and sedimentation control techniques and procedures shall conform to the "Manual For Erosion and Sediment Control in Georgia", latest edition.

2. Conduct the earthwork and excavation activities in such a manner to fit the topography, soil type and condition.

3. Minimize the disturbed area and the duration of exposure to erosion elements.

4. Stabilize disturbed areas immediately.

5. Safely convey run-off from the site to an outlet such that erosion will not be increased off site.

6. Retain sediment on site that was generated on site.

7. Minimize encroachment upon watercourses.

C. Implementation

1. The erosion and sedimentation control measures shown on the Drawings are minimal requirements. The Contractor's methods of operation may dictate additional erosion and sedimentation control measures not shown on the Drawings which shall be the Contractor's responsibility to determine and install said measures. The Contractor's failure to stabilize disturbed areas immediately following intermediate or final grading may dictate additional erosion and sedimentation control measures not shown on the Drawings which shall be the Contractor's responsibility to determine and install said measures.

2. The Contractor shall notify the County of any changes and/or additions to the erosion and sedimentation control plan necessary to accommodate the Contractor's methods of operation.

3. The Contractor shall be solely responsible for control of erosion within the Project site and prevention of sedimentation of any adjacent waterways.

4. The Contractor shall install controls which will ensure that storm water and drainage from the disturbed area of the Project site shall pass through some type of filter system before being discharged. The filter system must meet the requirements of the Georgia Erosion and Sedimentation Act of 1975 as amended.

D. Temporary Erosion and Sedimentation Control: In general, temporary erosion and sedimentation control procedures are those measures implemented as land disturbance activities are taking place and shall be directed towards:

1. Preventing soil erosion at the source.

2. Preventing silt and sediment from entering any waterway if soil erosion cannot be prevented.

3. Preventing silt and sediment from migrating downstream in the event it cannot be prevented from entering the waterway.

E. Permanent Erosion Control: Permanent erosion control measures shall be implemented to prevent sedimentation of the waterways and to prevent erosion of the Project site once construction activities are completed.

1.02 QUALITY ASSURANCE

A. General: Perform all work under this Section in accordance with all pertinent rules and regulations including, but not necessarily limited to, those stated herein and these Specifications.

B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

PART 2 PRODUCTS

2.01 TEMPORARY EROSION AND SEDIMENTATION CONTROL MATERIALS

A. Silt Fence: Silt fence shall meet the requirements of Section 171 - Temporary Silt Fence of the Department of Transportation, State of Georgia, Standard Specification, latest edition. Silt fence fabric must be on the Georgia DOT Qualified Product List.

B. Hay bales shall be clean, seed free cereal hay type.

C. Netting shall be 1/2-inch, galvanized steel, chicken wire mesh.

D. Filter stone shall be crushed stone conforming to Georgia Department of Transportation Table 800.01H, Size Number 203.

E. Concrete block shall be hollow, non-load-bearing type.

F. Plywood shall be 3/4-inch thick exterior type.

2.02 RIP RAP

A. Use only one method throughout the job.

B. Stone Rip Rap: Use sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Specific gravity shall be 2.0 or greater. Rip rap shall have less than 66 percent wear when tested in accordance with AASHTO T-96. Unless shown or specified otherwise, stone rip rap shall be Type 1 rip rap.

1. Type 1 Rip Rap: The largest pieces shall have a maximum volume of two cubic feet. At least 35 percent of the mass shall be comprised of pieces which weigh 125 pounds or more. The remainder shall be well graded down to the finest sizes. Rock fines shall comprise a maximum of 10 percent of the total mass. Rock fines are defined as material passing a No. 4 sieve. Rip rap size shall conform to Georgia Department of Transportation Section 805.01 Stone Dumped Rip Rap, Type 201

2. Type 3 Rip Rap: The largest pieces shall have a maximum approximate volume of one cubic foot. At least 35 percent of the mass shall be comprised of pieces which weigh 15 pounds or more. The remainder shall be well graded down to the finest sizes. Rock fines shall comprise a maximum of 10 percent of the total mass. Rock fines are defined as material passing a No. 4 sieve. Rip rap size shall conform to Georgia Department of Transportation Section 805.01 Stone Dumped Rip Rap, Type 203.

C. Sand-Cement Bag Rip Rap

1. The bags shall be of cotton, burlap or fiber reinforced paper capable of containing the sand-cement mixture without leakage during handling and placing. Bags previously used for sugar or any other material which will adversely affect the sand-cement mixture shall not be used. Capacity shall be not less than 0.75 cubic foot, nor more than two cubic feet.

2. Sand and Portland cement shall be mixed at the maximum ratio of 5:1 by weight and shall obtain a minimum compressive strength of 500 psi in seven days. For sand-cement bag rip rap, the amount of water used shall be just enough to make up the optimum moisture content of the aggregate and cement, as determined by AASHTO T 134. When sand-cement rip rap is to be pre-bagged, the sand-cement shall be mixed dry, and after placing each course, the bags shall be wetted until sufficient moisture is present for proper cement hydration.

2.03 FILTER FABRIC

A. The filter fabric for use under rip rap shall be a monofilament, polypropylene woven fabric meeting the specifications as established by Task Force 25 for the Federal Highway Administration. The filter fabric shall have an equivalent opening size (EOS) of 70.

B. Filter fabric shall meet the requirements of Trivera Spunbound 011/280. Mirafi 180N or Amoco 455203.

2.04 GRASS

A. Grass seed for temporary and permanent erosion control shall be of the time and applied at the rates and dates indicated on the Drawings.

B. For additional information regarding grassing and mulching activities, see the "Manual for Erosion and Sediment Control in Georgia", latest edition.

2.05 FERTILIZER

A. Commercial grass fertilizer with a 10N-10P-10K proportion.

B. Agricultural lime to be applied at a rate of one (1) ton per acre.

2.06 MULCH

A. Dry straw or hay of good quality, free of weed seed - spread at a rate of 2 1/2 tons per acre.

B. Wood waste, chips, sawdust or bark - spread 2 to 3 inches deep (about 6 to 9 tons per acre).

C. Erosion control matting or netting, such as excelsior, jute, textile and plastic matting and netting applied in accordance with manufacturer's recommendations.

2.07 EXCELSIOR MATTING

Curled wood excelsior blanket matting in accordance with GDOT Standard Specification Section 713.2.B. Staples shall be used to anchor the matting. U-shaped wire (11-gauge or greater) staples with legs at least 6 inches in length shall be used.

PART 3 EXECUTION

3.01 GENERAL

A. Temporary and permanent erosion and sedimentation control measures shall prevent erosion and prevent sediment from exiting the site. If in the opinion of the County the Contractor's temporary erosion and sedimentation control measures are inadequate, the Contractor shall provide additional maintenance for existing measures or additional devices to control erosion and sedimentation on the site.

B. All erosion and sedimentation control devices and structures shall be inspected by the Qualified Personnel at least once a week and within 24 hours of the end of a storm that is 0.5 inches or greater. Any device or structure found to be damaged will be repaired or replaced by the end of the day.

C. All erosion and sedimentation control measures and devices shall be constructed and maintained until adequate permanent disturbed area stabilization has been provided per local standards. Once adequate permanent stabilization has been provided and accepted by the local authority, all temporary erosion and sedimentation control structures and devices shall be removed.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt and sediment from entering the creeks. The preferred method is to provide an undisturbed natural buffer, extending a minimal 25 feet from the top of the bank, to filter the run-off.

B. Silt dams, silt fences, traps, barriers, check dams, appurtenances and other temporary measures and devices shall be installed as indicated on the approved plans and working drawings, shall be maintained until no longer needed, and shall then be removed. Deteriorated hay bales and dislodged filter stone shall be replaced with new materials. Detention ponds, if constructed, shall be maintained in a condition ensuring that unfiltered water will not leave the pond.

C. Excelsior Matting

1. Install matting where indicated on the Drawings.

2. Shape area to be protected to required shape and grade and thoroughly compact after seedbed preparation. Remove rocks or clods over 1½ in. in diameter and sticks and other material that will prevent contact of excelsior matting with the soil surface. Complete seeding and fertilizing activities prior to installing the excelsior matting.

3. Unroll excelsior matting in the direction of the flow of water with edges and ends butted snugly against each other. When unrolled, the netting shall be on top and the fibers in contact with the soil. The mats shall be anchored firmly to the soil with staples driven vertically into the ground and flush with the surface of the mats. On slopes flatter than 4H:1V, staples shall be spaced no more than 5 ft. apart on all edges and 1 ft. apart at all joints and ends. On all slopes 4H:1V or steeper or in depressions defined by the grading plans, staples shall be spaced 2½ to 3 ft. apart. At all joints and ends, staples shall be spaced no more than 6 in. apart. The spacing of staples may be modified to fit conditions as directed by the Owner.

D. Where permanent grassing is not appropriate, and where the Contractor's temporary erosion and sedimentation control practices is inadequate, the County may direct the Contractor to provide temporary vegetative cover with fast growing seedlings. Such temporary vegetative cover shall be provided by the Contractor in compliance with the Manual for Erosion and Sedimentation Control in Georgia, specifically in the selection of species, planting dates and application rates for seedlings, fertilizer and mulching, with the exception that kudzu shall not be permitted.

E. All erosion and sedimentation control devices, including check dams, shall be inspected by the Contractor at least weekly and after each rainfall occurrence and cleaned out and repaired by the Contractor as necessary.

F. Temporary erosion and sedimentation control devices shall be installed and maintained from the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

3.03 PERMANENT EROSION CONTROL

A. Permanent erosion control shall include:

1. Restoring the work site to its original contours, unless shown otherwise on the approved Drawings.

2. Permanent vegetative cover shall be performed in accordance with Article 3.03 of this Section.

3. Permanent stabilization of steep slopes and ditches shall be performed in accordance with Article 3.04 of this Section.

4. Stream bank restoration shall be provided for permanent stabilization of all creek and stream crossings. The restoration shall be in accordance with the standard details and the Manual for Erosion and Sediment Control in Georgia, latest edition.

B. Permanent erosion control measures shall be implemented as soon as practical after the completion of pipe installation or land disturbance for each segment of the Project. In no event shall implementation be postponed when no further construction activities will impact that portion or segment of the Project.

3.04 PERMANENT GRASSING

A. General

1. All references to grassing, unless noted otherwise, shall relate to establishing permanent vegetative cover as specified herein for seeding, fertilizing, mulching, etc.

2. When final grade has been established, all bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized and mulched in an effort to restore to a protected condition. Critical areas shall be sodded. All ditches and waterways shall have erosion control blankets installed as well as all slopes greater than 3:1 Erosion control blankets shall extend a minimum four feet from ditch bottom on both sides.

3. Specified permanent grassing shall be performed at the first appropriate season following establishment of final grading in each section of the site.

4. Permanent grassing shall be of a perennial species.

5. Permanent grassing shall be inspected for acceptable cover, which is a viable stand of grass that covers at least 98% of the total area with no bare spots exceeding one square foot and the ground surface is fully stabilized against erosion.

B. Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Where sod is removed or damaged, replant such areas using sod of the same species of grass at the first appropriate season. Outside of residential or landscaped areas, grass the entire area disturbed by the work on completion of work in any area. In all areas, promptly establish successful stands of grass.

C. Grassing activities shall comply with the Manual for Erosion and Sediment Control in Georgia, specifically for the selection of species; with the exception that kudzu shall not be permitted, planting dates and application rates for seeding, fertilizer and mulching. Where permanent vegetative cover (grassing) cannot be immediately established (due to season or other circumstances) the Contractor shall provide temporary vegetative cover. The Contractor must return to the site (at the appropriate season) to install permanent vegetation in areas that have received temporary vegetative cover.

3.05 RIP RAP

A. Rip rap shall be placed where drainage ditches are disturbed by excavation, or at all points where natural vegetation is removed from drainage ditches or other areas as identified on the Drawings. Carefully compact backfill and place rip rap to prevent subsequent settlement and erosion. This requirement applies equally to construction along side a stream or drainage ditch as well as crossing a stream or drainage ditch.

B. Preparation of Foundations: The ground surface upon which the rip rap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before placement is commenced. Where filling of depressions is required, the new material shall be compacted with hand or mechanical tampers. Unless as otherwise shown or specified, rip rap shall begin in a toe ditch constructed in original ground around the toe of the fill or the cut slope. The toe ditch shall be two feet deep in original ground, and the side next to the fill or cut shall have that same slope. After the rip rap is placed, the toe ditch shall be backfilled and the excess dirt spread neatly within the construction easement.

C. Placement of Filter Fabric: The surface to receive fabric shall be prepared to a relatively smooth condition free from obstructions, depressions and debris. The fabric shall be placed with the long dimension running up the slope and shall be placed to provide a minimum number of overlaps. The strips shall be placed to provide a minimum width of one foot of overlap for each joint. The filter fabric shall be anchored in place with securing pins of the type recommended by the fabric manufacturer. Pins shall be placed on or within 3-inches of the centerline of the overlap. The fabric shall be placed so that the upstream strip overlaps the downstream strip. The fabric shall be placed loosely so as to give and therefore avoid stretching and tearing during placement of the stones. The stones shall be dropped no more than three feet during construction. The fabric shall be protected at all times during construction from clogging due to clay, silts, chemicals or other contaminants.

D. Placement of Rip Rap: The rip rap shall be placed on a 6-inch layer of soil, crushed stone or sand overlaying the filter fabric. This 6-inch layer shall be placed to maximize the contact between the soil beneath the filter fabric and the filter fabric. Rip rap shall be placed with its top elevation conforming with the finished grade or the natural slope of the area being protected.

1. Stone Rip Rap: Stone rip rap shall be dumped into place to form a uniform surface and to the thickness specified on the Drawings. The thickness tolerance for the course shall be -6 inches and +12 inches.

2. Sand-Cement Bag Rip Rap: The bags shall be uniformly filled to the maximum capacity which will permit satisfactory tying. The bagged rip rap shall be placed by hand with the tied ends facing the same direction, with close, broken joints. After placing, the bags shall be rammed or

packed against one another to produce the required thickness and form a consolidated mass. The top of each bag shall not vary more than 3 inches above or below the required plane.

3.06 CLEAN-UP

A. Dispose of all excess erosion and sedimentation control materials in a manner satisfactory to the County.

B. All temporary erosion control measures shall be removed after final stabilization of the site has occurred, unless otherwise noted on the Drawings or instructed by the County.

END OF SECTION

SECTION 2.4 - BORE AND JACK CASINGS

PART 1 GENERAL

1.01 SCOPE

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.

1.02 CONTRACTOR EXPERIENCE

Boring and jacking casings is deemed to be specialty contractor work. If the Contractor elects to perform the work, the Contractor shall provide evidence of successful casing installations. A minimum of five continuous years of experience in steel casing construction is required of the casing installer.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

A. Casing

1. The casing shall be new and unused pipe. The casing shall be made from steel plate having a minimum yield strength of 35,000 psi. The steel plate shall also meet the chemical requirements of ASTM A 36.

2. The thickness of casing shown in paragraph B. below are minimum thickness. Actual thickness shall be determined by the casing installer, based on an evaluation of the required forces to be exerted on the casing when jacking. Any buckling of the casing due to jacking forces shall be repaired.

3. The diameters of casing shown in paragraph B. below are minimum. Larger casings, with the County's approval, may be provided, for whatever reasons the Contractor may decide, whether casing size availability, line and grade tolerances, soil conditions, etc.

4. In the event that casing is need for a crossing other than crossing a railroad or highway, the minimum casing shall correspond with the information listed on the table for crossing under highways.

B. Casing Sizes

Pipe Diameter, inches	UNDER RAILROADS		UNDER HIGHWAYS	
	Casing Diameter, inches	Casing Wall Thickness, inches	Casing Diameter, inches	Casing Wall Thickness, inches
6	14	0.250	12	0.250
8	18	0.312	16	0.250
10	20	0.344	16	0.250
12	22	0.344	20	0.250
14	24	0.375	22	0.250
16	30	0.469	24	0.250
18	30	0.469	30	0.312
20	32	0.501	30	0.312
24	36	0.532	36	0.375

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 85-90 durometer. Runners shall be attached to stainless steel risers which 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 or Advanced Products & Systems, Inc.

2. Casing spacers shall be a two-section, flanged, bolt on style constructed of heat fused PVC coated steel, minimum 14 gauge band and 10 gauge risers, with 2-inch wide glass reinforced polyester insulating skids, heavy duty PVC inner liner, minimum 0.09-inch thick having a hardness of 85-90 durometer, and all stainless steel or cadmium plated hardware shall be Pipeline Seal and Insulator, Inc.

2.02 EQUIPMENT

A. A cutting head shall be attached to a continuous auger mounted inside the casing pipe.

B. On casing pipe for gravity sewer over 60 feet in length, the installation equipment shall include a steering head and a grade indicator.

C. 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 that meets industry standards.

PART 3 EXECUTION

3.01 GENERAL

A. Interpretation of soil investigation reports and data, investigating the site and determination of the site soil conditions is the sole responsibility of the Contractor. Any subsurface investigation by the Contractor must be approved by the appropriate authority having jurisdiction over the site.

B. Casing 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 casing. Support the ground continuously in a manner that will 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 casing operations and shall repair and restore damaged property to its original or better condition.

C. Face Protection: The face of the excavation shall be protected from the collapse of the soil into the casing.

D. Casing Design: Design of the bore pit and required bearing to resist jacking forces are the responsibility of the Contractor. The excavation method selected shall be compatible with expected ground conditions.

E. Highway Crossings

1. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the highway right-of-way.

2. Work along or across the highway department rights-of-way shall be subject to inspection by such highway department.

3. All installations shall be performed to leave free flows in drainage ditches, pipes, culverts or other surface drainage facilities of the highway, street or its connections.

4. No excavated material or equipment shall be placed on the pavement or shoulders of the roadway without the express approval of the highway department.

5. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed, which are placed on the right-of-way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the roadway.

6. The Contractor shall be responsible for obtaining a blasting permit in a timely manner.

F. Railroad Crossings

1. The Contractor shall secure permission from the Railroad to schedule work so as not to interfere with the operation of the Railroad.

2. All work on the Railroad right-of-way, including necessary support of tracks, safety of operations and other standard and incidental operation procedures may be under the supervision of the appropriate authorized representative of the Railroad affected and any decisions of this representative pertaining to construction and/or operations shall be final and construction must be governed by such decisions.

3. If, in the opinion of the Railroad, it becomes necessary to provide flagging protection, watchmen or the performance of any other work in order to keep the tracks safe for traffic, the Contractor shall coordinate such work and shall reimburse the Railroad, in cash, for such services, in accordance with accounting procedures agreed on by the Contractor and affected Railroad before construction is started.

4. No blasting shall be permitted within the Railroad right-of-way.

3.02 GROUNDWATER CONTROL

A. The Contractor shall control the groundwater throughout the construction of the casing.

B. 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, take such action as necessary to maintain safe conditions and prevent damage.

C. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24 hour basis keeping excavations free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum. Dewater into a sediment trap.

3.03 SAFETY

A. Provide all necessary bracing, 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.

B. Observe all applicable requirements of the regulations of the authorities having jurisdiction over this site. Conduct the operations in such a manner that all work will be performed below the level of the roadbed.

C. Perform all activities in accordance with the Occupational Safety and Health Act of 1970 (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".

3.04 SURFACE SETTLEMENT MONITORING

Monitoring of any observed settlement shall be as directed by the Owner. Any settlement shall be corrected by, and at the expense of, the Contractor.

3.05 BORING AND JACKING

A. Shaft

1. Conduct boring and jacking operations from a shaft excavated at one end of the section to be bored. Where conditions and accessibility are suitable, place the shaft on the downstream 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 loading of whatever nature due to site and soil conditions. Keep preparations dry during all operations. Perform pumping operations as necessary.

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 if required due to soil conditions.

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.

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. As the casing is installed, check the horizontal and vertical alignment frequently. Make corrections prior to continuing operation. For casing pipe installations over 100 feet in length, the auger shall be removed and the alignment and grade checked at minimum intervals of 60 feet.

H. Any casing pipe damaged in jacking operations shall be repaired, or removed and replaced at Contractor's own expense.

I. Lengths of casing pipe, as long as practical, shall be used except as restricted otherwise. Joints between casing pipe sections shall be butt joints with complete joint penetration, single groove welds, for the entire joint circumference, 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 prepare a contingency plan which will 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 should 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 will 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, the sheeting, shoring and bracing shall be left in place, cut off or removed.

O. All surplus material shall be removed from the right-of-way and the excavation finished flush with the surrounding ground.

P. Grout backfill shall be used for unused holes or abandoned pipes.

Q. Any replacement of carrier pipe in an existing casing shall be considered a new installation, subject to the applicable requirements of these Specifications.

3.06 FREE BORING

A. Where a pipeline is approved by jurisdictional authorities to be installed by boring without casing, the Contractor shall construct the crossing by the free bore method. The free bore method shall be accomplished by the dry auger boring method without jetting, sluicing, or wet boring.

B. The diameter of the free bore shall not exceed the pipe bell outside diameter or the pipe barrel outside plus 1-inch, whichever is greater.

C. Free boring, where approved by jurisdictional authorities, is to be performed at the Contractor's option. The Contractor may choose to construct the crossing by the conventional bore and jack casing methodology.

D. The Contractor shall be responsible for any settlement of the roadway caused by the free bore construction activities.

E. If the Contractor elects to free bore, and an acceptable installation does not result for any reason, the Contractor shall install a casing pipe by the bore and jack method.

3.07 VENTILATION AND AIR QUALITY

Provide, operate and maintain for the duration of casing project a ventilation system to meet safety and OSHA requirements.

3.08 ROCK EXCAVATION

A. In the event that rock is encountered during the installation of the casing pipe which cannot be removed through the casing, the Contractor may complete the crossing by a method established in a change order.

B. At the Contractor's option, the Contractor may continue to install the casing and remove the rock through the casing.

3.09 INSTALLATION OF CARRIER PIPE

A. Check the alignment and grade of the casing and prepare a plan to set the carrier pipe at proper alignment, grade and elevation, without any sags or high spots.

B. The pipe shall be supported within the casing by use of casing spacers sized to limit radial movement to a maximum of 1-inch. Provide a minimum of two casing spacers per nominal length of pipe. Casing spacers shall be attached to

the pipe at maximum 10 foot intervals. Casing spacers shall also be provided within two feet of each end of the casing.

C. Joints shall be restrained joint type for pipe and standard mechanical restrained joints for fittings. Mechanical joints shall conform to AWWA C11201 Restrained joints shall be equal to American "FLEX-RING" or "Fast-Grip", or U.S. Pipe "TR FLEX" or "Field-Lok Gasket". No field welding of restrained joint pipe will be permitted.

D. Close the ends of the casing with brick bulkheads using brick and mortar.

3.10 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 as not to endanger or damage either new or existing structures, private or public properties and also to avoid cave-ins or sliding in the banks.

END OF SECTION

SECTION 2.5 - TRENCH EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 SCOPE

A. The work 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 as specified.

B. Excavation shall include the removal of any trees, stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and 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 as specified.

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. The pipe zone area of the trench is divided into five specific areas:

1. Foundation: The area beneath the bedding, sometimes also referenced 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. Haunching: 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 18-inches above the top of the barrel of the pipe.

5. Final Backfill: The area above a plane 18-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.

1.02 QUALITY ASSURANCE

A. Density: All references to "maximum dry density" shall mean the maximum dry density defined by the "Maximum Density-Optimum Moisture Test", ASTM D 698. Determination of the density of foundation, bedding, haunching, or backfill materials in place shall meet with the requirements of ASTM D 1556, "Density of Soil In Place by the Sand Cone Method", ASTM D 2937, "Density of Soil In Place by the Drive-Cylinder Method" or ASTM D 2922, "Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)".

B. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specification requirements shall be performed by an independent testing laboratory. The Contractor's testing laboratory shall perform tests upon change of source and at sufficient intervals during the work to certify conformance of all select material furnished for use on the Project.

1.03 SAFETY

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 2226.

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 Specification 800.01, 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. Crushed stone utilized for bedding and haunching shall meet the requirements of the Georgia Department of Transportation Specification 800.01, Group I (limestone, marble or dolomite) or Group II (quartzite, granite or gneiss). Stone size shall be between No. 57 and No. 4, inclusive.

B. Earth materials utilized for bedding and haunching shall be suitable materials selected from materials excavated from the trench. The earth materials excavated from trenching operations shall conform to Class I, II, or III as described in ASTM 2321, if such materials are to be use for bedding or haunching for sewer pipe. Suitable materials shall also be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated

from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as bedding or haunching material, provide select material conforming to the requirements of this Section.

C. Filter Fabric

1. Filter fabric associated with bedding shall be a polypropylene woven fabric. The fabric shall be a high modulus type with good separation capabilities. The fabric shall be inert to biological degradation and naturally occurring chemicals, alkalis and acids.

2. The fabric shall have an equivalent opening size (EOS or AOS) of 20 to 45. The fabric shall also conform to the minimum property values listed in the following table:

Fabric Property	Unit	Test Method	Minimum Value
Grab Tensile Strength	lbs.	ASTM D 4632	200
Grab Tensile Elongation	%	ASTM D 4632	30 (max.)
Mullen Burst Strength	psi	ASTM D 3786	400
Trapezoid Tear Strength	lbs.	ASTM D 4533	75
Puncture Strength	lbs.	ASTM D 3787	75

3. If ordered 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 will be furnished for a minimum of 10 days during initial pipe installation.

4. Filter fabric shall be Mirafi 500X, Amoco 2002 or Exxon GTF-200.

2.03 INITIAL BACKFILL

A. Initial backfill material shall be crushed stone or earth materials as specified for bedding and haunching materials.

B. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as initial backfill material, provide select material conforming to the requirements of this Section.

2.04 FINAL BACKFILL

Final backfill material shall be general excavated earth materials, shall not contain rock larger than 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, provide select material conforming to the requirements of this Section.

2.05 SELECT BACKFILL

Select backfill shall be materials which meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.

PART 3 EXECUTION

3.01 TRENCH EXCAVATION

A. Topsoil and grass shall be stripped a minimum of 6-inches over the trench excavation site and stockpiled separately for replacement over the finished grading areas.

B. Trenches shall be excavated to the required lines and grades with the centerlines of the trenches on the centerlines of the pipes and to the dimensions which provide the proper support and protection of the pipe and other structures and accessories.

C. Width

1. The sides of all trenches shall be vertical to a minimum of one foot above the top of the pipe. The maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.

2. Excavate the top portion of the trench to any width within the construction easement or right-of-way which will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.

3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 9-inch clearance between the rock and any part of the pipe barrel or manhole.

4. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher class (load factor) of bedding and haunching for the full trench width as actually cut, at no additional cost to

the Owner. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused 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 Engineer or Owner.

D. Depth

1. The trenches shall be excavated to the required depth or elevation which allow for the placement of the pipe and bedding to the thickness required for proper support.

2. Water Mains and Force Mains

a. Excavate trenches to provide a minimum of four feet cover measured from the top of the pipe to the ground surface. Within the right-of-way of highways, streets or roadways, also excavate to place the top of the pipe a minimum of four feet below the nearest pavement edge.

b. Increase the depth of cover, as measured from the top of pipe, where necessary to avoid interference with underground utilities and obstructions.

3. Where rock is encountered in trenches, excavate to the minimum depth which will provide clearance below the pipe barrel of 8 inches for pipe 21 inches in diameter and smaller and 12 inches for larger pipe, valves and manholes. Remove boulders and stones to provide a minimum of 6-inch clearance between the rock and any part of the pipe, manhole or accessory.

E. Excavated Material

1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Topsoil shall be carefully separated and lastly placed in its original location.

2. 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.

3.02 SHEETING, BRACING AND SHORING

A. 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 necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees or private properties which are required to remain.

5. Where necessary to maintain the top of the trench within the available construction easement or right-of-way.

6. Sheeting shall be steel sheeting.

B. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970, as amended.

C. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.

D. 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 must 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 will 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.

E. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when it cannot be safely removed. Cut off any sheeting left in place at least two feet below the surface.

3.03 ROCK EXCAVATION

A. Definition of Rock: Any material which cannot be excavated with conventional excavating equipment, and is removed by drilling and blasting, and occupies an original volume of at least one-half cubic yard.

B. Blasting: Provide licensed, experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all buildings and structures from the effects of the blast. Repair any resulting damage.

C. Removal of Rock: Dispose of rock off site that is surplus or not suitable for use as rip rap or backfill.

D. The Contractor shall notify the County prior to any blasting. Additionally, the Contractor shall notify the County before any charge is set.

E. Following review by the County regarding the proximity of permanent buildings and structures to the blasting site, the County may direct the Contractor to employ an independent, qualified specialty subcontractor, approved by the County, to monitor the blasting by use of seismograph, identify the areas where light charges must be used, conduct pre-blast and post-blast inspections of structures, including photographs or videos, and maintain a detailed written log.

3.04 DEWATERING EXCAVATIONS

A. Dewater excavation continuously to maintain a water level two feet below the bottom of the trench.

B. Control drainage in the vicinity of excavation so the ground surface is properly pitched to prevent water running into the excavation.

C. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations. Where the pipe line crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property.

D. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.

E. 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 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 two 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 operation.

F. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet below the trench bottom. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10-inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing.

3.05 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 will be determined to be unsuitable and require trench stabilization.

C. Should the undisturbed material encountered at the trench bottom constitute, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed stone.

D. 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 two feet below the specified trench bottom. 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.

E. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

3.06 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 BCWSS Standard Details, and the pipe shall be placed thereon and brought to grade by tamping the bedding material or by removal of the slight excess amount of the bedding material under the pipe. Adjustment to grade 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. All bedding shall extend the full width of the trench bottom.

C. At each joint, 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, 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: Excavate the bottom of the trench flat at a minimum depth as required below the bottom of the pipe barrel. 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 (Class B) for PVC pipe and up to a height of one-fourth the outside diameter of the pipe above the bottom of the pipe barrel (Class C) for ductile iron pipe. Bedding shall be in accordance with ASTM D 2321.

F. Manholes: Excavate to a minimum of 12-inches below the planned elevation of the base of the manhole. Place and compact crushed stone bedding material to the required grade before constructing the manhole.

G. Water Lines and Force Mains

1. Bedding and Haunching Materials: Utilize earth materials for Type 2 and Type 3 bedding installations and crushed stone for Type 4 and Type 5 bedding installations.

2. Ductile Iron Pipe

a. Slip-on pipe shall utilize Type 2 bedding at a minimum.

b. Restrained joint pipe shall utilize Type 3 bedding at a minimum.

3. Polyvinyl Chloride Pipe (PVC): Shall utilize Type 2 bedding at a minimum.

4. Type 4 or Type 5 bedding shall be used in wet trench conditions or where laying conditions where laying conditions require.

H. High Density Polyethylene Pipe (HDPE) - Force Mains: Bedding and haunching materials shall utilize crushed stone, Class 1 material in accordance with ASTM D 2774.

I. Excessive Width and Depth

A. Gravity Sewers: If the trench is excavated to excess width, provide the bedding class with the next higher bedding factor. Crushed stone haunching and initial backfill may be used in lieu of Class A bedding, where Class A bedding is necessitated by excessive trench width.

B. Water and Force Mains: If the trench is excavated to excess width, provide the next higher type or class of pipe bedding, but a minimum of Type 4.

C. If the trench is excavated to excessive depth, provide crushed stone to place the bedding at the proper elevation or grade.

J. Compaction: Bedding and haunching materials under pipe, manholes and accessories shall be compacted to a minimum of 90 percent of the maximum dry density, unless shown or specified otherwise.

3.07 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. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 18 inches above the pipe barrel. Layer depths shall be a maximum of 6 inches for pipe 18 inches in diameter and smaller and a maximum of 12 inches for pipe larger than 18 inches in diameter.

C. Backfill on both sides of the pipe simultaneously to prevent side pressures.

D. Compact each layer thoroughly with suitable hand tools or tamping equipment.

E. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density.

F. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

G. Initial backfill material for HDPE force mains shall be crushed stone, Class 1 material in accordance with ASTM D 2774.

3.08 CONCRETE ENCASEMENT

A. Where concrete encasement is required, excavate the trench to provide a minimum of 6 inches clearance from the bell of the pipe. Lay the pipe to line and grade on concrete blocks. In lieu of bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than 6 inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.

B. For pipes under structures, provide concrete backfill.

3.09 FINAL BACKFILL

A. Backfill carefully to restore the ground surface to its original condition.

B. The top 6-inches shall be topsoil obtained as required under Article 3.01.A of this Section.

C. Excavated material which is unsuitable for back filling, and excess material, shall be disposed of. Surplus soil may be neatly distributed and spread over the site if approved by the County. If such spreading is allowed, the site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.

D. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

E. After initial backfill material has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:

1. In 6-inch layers, if using light power tamping equipment, such as a "jumping jack".

2. In 12-inch layers, if using heavy tamping equipment, such as hammer with tamping feet.

3. In 24-inch layers, if using a hydra-hammer.

F. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.

G. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density.

3.10 ADDITIONAL MATERIAL

Where final grades above the pre-construction grades are required to maintain minimum cover, additional fill material will be required. 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, provide additional suitable fill material.

3.11 BACKFILL UNDER ROADS

Compact backfill underlying pavement and sidewalks, and backfill under dirt and gravel roads to a minimum 95 percent of the maximum dry density. The top 12-inches shall be compacted to a minimum of 98 percent of the maximum dry density.

3.12 BACKFILL WITHIN GEORGIA DOT RIGHT-OF-WAY

Backfill within the Georgia DOT right-of-way shall meet the requirements stipulated in the "Utility Accommodation Policy and Standards", published by the Georgia Department of Transportation.

3.13 BACKFILL ALONG RESTRAINED JOINT PIPE

Backfill along restrained joint pipe shall be compacted to a minimum 90 percent of the maximum dry density, unless located under pavement, sidewalks, dirt roads, or gravel roads in which case compaction shall be as specified in Article 3.11 of this Section. If pipe is located within Georgia DOT right-of-way, compaction shall be as specified in Article 3.11 of this Section

3.14 DETECTION TAPE

Where required, detection tape shall be buried 4 to 10-inches beneath the ground surface directly over the top of the pipe. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20-inches from the finished grade surface.

3.15 TESTING AND INSPECTION

A. The soil testing will be performed by an independent testing laboratory selected by the County.

B. The soils testing laboratory is responsible for the following:

1. Compaction tests in accordance with Article 1.02 of this Section.

2. Field density tests for each two feet of lift, one test for each 2,000 feet of pipe installed or more frequently if ordered by the County.

3. Inspecting and testing stripped site, subgrades and proposed fill materials.

C. The Contractor's duties relative to testing include:

1. Notifying laboratory of conditions requiring testing.

2. Coordinating with laboratory for field testing.

3. Providing excavation as necessary for laboratory personnel to conduct tests.

D. Inspection

1. Earthwork operations, acceptability of excavated materials for bedding or backfill, and placing and compaction of bedding and backfill is subject to inspection by the County.

2. Foundations and shallow spread footing foundations are required to be inspected by a geotechnical engineer, who shall verify suitable bearing and construction.

E. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.

END OF SECTION

SECTION 2.6 - REMOVING AND REPLACING PAVEMENT

PART 1 GENERAL

1.01 SCOPE

The work to be performed under this Section shall consist of removing and replacing existing pavement, sidewalks and curbs in paved areas where such have been removed for construction of water mains, fire hydrants, sewers, manholes and all other water and sewer appurtenances and structures.

1.02 SUBMITTALS

Certificates: When requested by the County, provide certificates stating that materials supplied comply with Specifications. Certificates shall be signed by the asphalt producer and the Contractor.

1.03 CONDITIONS

A. Paving operations shall not begin until all underground work has been completed in areas to be paved.

B. Weather Limitations

1. Apply bituminous prime and tack coats only when the ambient temperature in the shade has been at least 50 degrees F for 12 hours immediately prior to application.

2. Do not conduct paving operations when surface is wet or contains excess of moisture which would prevent uniform distribution and required penetration.

3. Construct asphaltic courses only when atmospheric temperature in the shade is above 40 degrees F, when the underlying base is dry and when weather is not rainy.

4. Place base course when air temperature is above 35 degrees F and rising.

C. Grade Control: Establish and maintain the required lines and grades for each course during construction operations.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

A. Graded Aggregate Base Course: Graded aggregate base course shall be of uniform quality throughout and shall meet the requirements of Section 815.01 of the Georgia Department of Transportation Standard Specifications.

B. Binder Course: The binder course of all paved roadways shall conform to the requirements of Section 400, Type "B" of the Georgia Department of Transportation Standard Specifications.

C. Surface Course: The surface course for all pavement, including prime or tack coat when required by the Engineer, shall conform to the requirements of Section 400, Type "F" of the Georgia Department of Transportation Standard Specifications.

D. Concrete: Provide concrete and reinforcing for concrete pavement or base courses in accordance with the requirements of the Georgia Department of Transportation Standard Specifications, Section 430. Concrete shall be of the strength classifications that matches or exceeds that of existing concrete being replaced.

E. Special Surfaces: Where driveways or roadways are disturbed or damaged which are constructed of specialty type surfaces, e.g., brick or stone, these driveways and roadways shall be restored utilizing similar, if not original, materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed.

2.02 TYPES OF PAVEMENTS

A. General: All existing pavement removed, destroyed or damaged by construction shall be replaced with the same type and thickness of pavement as that existing prior to construction. Materials, equipment and construction methods used for paving work shall conform to the Georgia Department of Transportation specifications applicable to the particular type required for replacement, repair or new pavements.

B. Aggregate Base: Aggregate base shall be constructed in accordance with the requirements of Section 310 of the Georgia Department of Transportation Standard Specifications. The maximum thickness to be laid in a single course shall be 6-inches compacted. If the design thickness of the base is more than 6-inches, it shall be constructed in two or more courses of approximate equal thickness. After the material placed has been shaped to line, grade and cross-section, it shall be rolled until the course has been uniformly compacted to at least 100 percent of the maximum dry density when Group 2 aggregate is used, or to at least 98 percent of maximum dry density when Group 1 aggregate is used.

C. Concrete Pavement: Concrete pavement or base courses shall be replaced with concrete. The surface finish of the replaced concrete pavement shall conform to that of the existing pavement. The surface of the replaced concrete base course shall be left rough. The slab depth shall be equivalent to the existing concrete pavement or base course, but in no case less than 6-inches thick. Transverse and longitudinal joints removed from concrete pavement shall be replaced at the same locations and to the same types and dimensions as those removed. Concrete pavements or concrete base courses shall be reinforced.

D. Asphaltic Concrete Binder and Surface Course: Asphaltic concrete binder and surface course construction shall conform to Georgia Department of Transportation Standard Specifications, Section 400. The pavement mixture shall not be spread until the designated surface has been previously cleaned and prepared, is intact, firm, properly cured, dry and the tack coat has been applied. After concrete base installation, apply and compact the surface course. Immediately correct any high, low or defective areas by cutting out the course, replacing with fresh hot mix, and immediately compacting to conform and thoroughly bond to the surrounding area.

E. Surface Treatment Pavement: Bituminous penetration surface treatment pavement shall be replaced with a minimum thickness of 1-inch conforming to Section 424, Georgia Department of Transportation Standard Specifications.

F. Gravel Surfaces: Existing gravel road, drive and parking area replacement shall meet the requirements of graded aggregate base course. This surfacing may be authorized as a temporary surface for paved streets until replacement of hard surfaced pavement is authorized.

G. Temporary Measures: During the time period between pavement removal and complete replacement of permanent pavement, maintain highways, streets and roadways by the use of steel running plates anchored to prevent movement. The backfill above the pipe shall be compacted, as specified in BCWSS Standards, up to the existing pavement surface to provide support for the steel running plates. All pavement shall be replaced within seven calendar days of its removal.

PART 3 EXECUTION

3.01 LOCATIONS FOR PAVEMENT REPLACEMENT

Locations for pavement replacement shall be in accordance with the standard details.

3.02 REMOVING PAVEMENT

A. General: Remove existing pavement as necessary for installing the pipe line and appurtenances.

B. Marking: Before removing any pavement, mark the pavement neatly paralleling pipe lines and existing street lines. Space the marks the width of the trench.

C. Breaking: Break asphalt pavement along the marks using pavement shearing equipment, jack hammers 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 jack hammers or other suitable tools.

D. Machine Pulling: Do not pull pavement with machines until the pavement is completely broken and separated from pavement to remain.

E. Damage to Adjacent Pavement: Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.

F. Sidewalk: Remove and replace any sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.

G. Curbs: Tunnel under or remove and replace any curb disturbed by construction to the nearest undisturbed joint.

3.03 REPLACING PAVEMENT

A. Preparation of Subgrade: Upon completion of back filling and compaction of the backfill, arrange to have the compaction tested by an independent testing laboratory. After compaction testing has been satisfactorily completed, replace all pavements, sidewalks and curbs removed.

1. The existing street pavement or surface shall be removed along the lines of the work for the allowable width specified for the trench or structure. After the installation of the sewerage or water works facilities and after the backfill has been compacted suitably, the additional width of pavement to be removed shall be done immediately prior to replacing the pavement.

2. Trench backfill shall be compacted for the full depth of the trench as specified in Section 5 - Trench Excavation and Backfill.

3. Temporary trench backfill along streets and driveways shall include 6 inches of crushed stone or cherty clay as a temporary surfacing of the trenches. This temporary surface shall be maintained carefully at grade and dust-free by the Contractor until the backfill of the trench has thoroughly compacted.

4. When temporary crushed stone or chert surface is considered by the County to be sufficient surface for gravel pavement, the surface shall be graded smooth and to an elevation that will make the final permanent surfacing level with the adjacent surfacing that was undisturbed.

B. Pavement Replacement

1. Prior to replacing pavement, make a final cut in concrete pavement 12 inches back from the edge of the damaged pavement with a concrete saw. Remove asphalt pavement 12 inches back from the edge of the damaged pavement using pavement shearing equipment, jack hammers or other suitable tools.

2. Replace driveways, sidewalks and curbs with the same material, to nearest existing undisturbed construction joint and to the same dimensions as those existing.

3. If the temporary crushed stone or chert surface is to be replaced, the top 6 inches shall be removed and the crushed stone surfacing for unpaved streets or the base for the bituminous surface shall be placed.

4. Following this preparation, the chert or crushed stone base shall be primed with a suitable bituminous material and surfaced with the proper type of bituminous surface treatment.

5. Where the paved surface is to be replaced with asphaltic concrete pavement, concrete pavement or with a concrete base and a surface course, the temporary chert or crushed stone surface and any necessary backfill material, additional existing paving and new excavation shall be removed. All edges of the existing pavement shall be cut to a straight, vertical edge. Care shall be used to get a smooth joint between the old and new pavement and to produce an even surface on the completed street. Concrete base slabs and crushed stone bases, if required, shall be placed and allowed to cure for three days before bituminous concrete surface courses are applied. Expansion joints, where applicable, shall be replaced in a manner equal to the original joint.

6. Where driveways or roadways, constructed of specialty type surfaces, e.g., brick or stone are disturbed or damaged, these driveways and roadways shall be restored utilizing similar materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed.

C. Pavement Resurfacing

1. Where pavement to be resurfaced has been damaged with potholes, the Contractor shall remove all existing loose pavement material and fill the hole with black base, as specified, to the level of the existing pavement. After all pipe line installations are complete and existing pavement has been removed and replaced along the trench route, apply tack coat and surface course as specified.

2. Resurfacing limits shall be perpendicular to the road centerline. The limits of resurfacing shall be 10 feet beyond the edge of the pavement replacement on the main road being resurfaced, and to the point of tangency of the pavement on the side streets.

D. Pavement Striping: Pavement striping removed or paved over shall be replaced with the same type, dimension and material as original.

3.04 SIDEWALK AND CURB REPLACEMENT

A. Construction

1. All concrete sidewalks and curbs shall be replaced with concrete.

2. Preformed joints shall be 1/2-inch thick, conforming to the latest edition of AASHTO M59 for sidewalks and AASHTO M 123 for curbs.

3. Forms for sidewalks shall be of wood or metal, shall be straight and free from warp, and shall be of sufficient strength, when in place, to hold the concrete true to line and grade without springing or distorting.

4. Forms for curbs shall be metal and of an approved section. They shall be straight and free from distortions, showing no vertical variation greater than 1/8-inch in 10 feet and no lateral variation greater than 1/4-inch in 10 feet from the true plain surface on the vertical face of the form. Forms shall be of the full depth of the structure and constructed such to permit the inside forms to be securely fastened to the outside forms.

5. Securely hold forms in place true to the lines and grades required.

6. Wood forms may be used on sharp turns and for special sections, as approved by the Engineer. Where wooden forms are used, they shall be free from warp and shall be the nominal depth of the structure.

7. All mortar and dirt shall be removed from forms and all forms shall be thoroughly oiled or wetted before any concrete is deposited.

B. 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 required to prevent cracking.

C. 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 4-inches. The new work shall be neatly jointed to the existing concrete so that the surface of the new work shall form an even, unbroken plane with the existing surfaces.

D. The subgrade shall be formed by excavating to a depth equal to the thickness of the concrete, plus 2-inches. Subgrade shall be of such width as to permit the proper installation and bracing of the forms. Subgrades shall be compacted by hand tamping or rolling. Soft, yielding or unstable material shall be removed and backfilled with satisfactory material. Place 2-inches of porous crushed stone under all sidewalks and curbs and compacted thoroughly, then finish to a smooth, unyielding surface at proper line, grade and cross section.

E. Joint for Curbs

1. Construct joints true to line with their faces perpendicular to the surface of the structure and within 1/4-inch of their designated position.

2. Thoroughly spade and compact the concrete at the faces of all joints filling all voids.

3. Install expansion joint materials at the point of curve at all street returns. Install expansion joint material behind the curb at abutment to sidewalks and adjacent structures.

4. Place contraction joints every 10 feet along the length of the curbs and gutters. Form contraction joints using steel templates or division plates which 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. Contraction joint templates or plates shall not extend below the top of the steel reinforcement or they shall be notched to permit the reinforcement to be continuous through the joint. Contraction joints shall be a minimum of 1-1/2-inches deep.

F. Expansion joints shall be required to replace any removed expansion joints or in new construction as required. Expansion joints shall be true and even, shall present a satisfactory appearance, and shall extend to within 1/2-inch of the top of finished concrete surface.

G. 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.

3. Finish edges with an approved finishing tool having a 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 1/8-inch in 10 feet from the established grade.

H. Concrete shall be suitably protected from freezing and excessive heat. It shall be kept covered with burlap or other suitable material and kept wet until cured. Provide necessary barricades to protect the work. All damage caused by people, vehicles, animals, rain, the Contractor's operations and the like shall be repaired by the Contractor.

3.05 MAINTENANCE

The Contractor shall maintain the surfaces of roadways built and pavements replaced until the acceptance of the Project. Maintenance shall include replacement, scraping, reshaping, wetting and rerolling as necessary to prevent raveling of the road material, the preservation of reasonably smooth surfaces and the repair of damaged or unsatisfactory surfaces. Maintenance shall include sprinkling as may be necessary to abate dust from the gravel surfaces.

3.06 SUPERVISION AND APPROVAL

A. Pavement restoration shall meet the requirements of the regulatory agency responsible for the pavement. Obtain agency approval of pavement restorations before requesting final payment.

B. Complete pavement restoration as soon as possible after backfilling.

C. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the bonded period, promptly restore or repair defects.

3.07 CLEANING

The Contractor shall remove all surplus excavation materials and debris from the street surfaces and rights-of-way and shall restore street, roadway or sidewalk surfacing to its original condition.

END OF SECTION

SECTION 2.7 - CHAIN LINK FENCE AND GATES

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall furnish all labor, materials, equipment and miscellaneous items as necessary for the installation of a complete chain link fence system. Fencing shall be installed in complete conformity with the manufacturer's written recommendations and as specified herein.

B. Fencing used solely for security of the Contractor's equipment and materials during construction is at Contractor's option and is not included as part of the work specified.

1.02 DELIVERY AND HANDLING

A. Deliver materials with the manufacturer's tags and labels intact.

B. Handle and store materials in such a manner that will avoid damage.

1.03 QUALITY ASSURANCE

A. Standards of manufacturer shall comply with the standards of the Chain Link Manufacturers Institute and these Specifications.

B. Provide fencing as a complete unit produced by a single manufacturer including the required erection accessories, fittings and fasteners.

PART 2 PRODUCTS

2.01 GENERAL

A. Overall height for new fencing shall be six feet including three strands of barbed wire on malleable iron post tops. Posts shall be set at no more than 10 foot centers, a full three feet deep in concrete footings, poured the full size of the holes as excavated. Corner posts shall have the necessary strut and tie bracing. Gates shall be provided of the size and at the locations indicated on the Drawings.

B. Where fencing crosses ditches, steep grades, and other unusual conditions, make special provisions to insure that the security, appearance, maintainability and permanence of the standard fencing are equaled or exceeded.

2.02 MATERIALS AND CONSTRUCTION

A. Fence Mesh: 9 gauge wire, woven to 2-inch squares, galvanized after weaving, six foot wide roll. Continuous tension wire shall be provided at the lower edge of the mesh.

B. Line Post: 2-1/2-inch O.D. Galvanized Pipe (203.65 #/ft.).

C. Corner Post: 3-inch O.D. Galvanized Pipe (5.79 #/ft.).

D. Gate Post: 4-inch O.D. Galvanized Pipe (9.11 #/ft.).

E. Top Rail: 1-5/8-inch O.D. Galvanized Pipe (2.27 #/ft.) with extra long pressed steel sleeves.

F. Gates shall be supplied with heavy-duty latches, keepers and heavy duty hardened bronze padlocks with duplicate keys.

G. Gate Frames: 2-inch O.D. Galvanized Pipe Frame (2.72 #/ft.).

H. Barbed wire shall consist of three strands of 12 gauge wire, with 4-point pattern barbs, galvanized after weaving.

PART 3 EXECUTION

3.01 INSTALLATION

A. Fence installation shall not be started before the final grading is completed, with finish grade elevations established, unless otherwise permitted.

B. Excavation: Drill holes of diameters and spacing required, for post footings in firm, undisturbed or compacted soil.

1. Excavate holes to the minimum diameters as recommended by fence manufacturer.

2. Unless otherwise indicated, excavate hole depths approximately 3-inches lower than the post bottom, with bottom of posts set not less than 36-inches below the surface when in firm, undisturbed soil.

3. If solid rock is encountered near the surface, drill into rock at least 12-inches for line posts and at least 18-inches for end, pull corner, and gate posts. Drill hole at least 1-inch greater diameter than the largest dimension for the post to be placed. If solid rock is below soil overburden, drill to full depth required. Penetration into rock need not exceed the minimum depths specified above.

C. Setting Posts: Remove loose and foreign materials from sides and bottoms of holes and moisten soil prior to placing concrete.

1. Center and align posts in holes 3-inches above bottom of excavation.

2. Place concrete around posts in a continuous pour and vibrate or tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operations.

3. Trowel finish tops of footings and slope of dome to direct water away from posts. Extend footings for gate posts to the underside of bottom hinge. Set keeps, stops, sleeves and other accessories into concrete as required.

4. Keep exposed concrete surfaces moist for at least seven days after placement or cure with membrane curing materials or other acceptable curing methods.

5. Grout-in posts set into sleeved holes, concrete constructions or rock excavations with non-shrink Portland cement grout or other acceptable grouting material.

D. Concrete Strength: Allow concrete to attain at least 75 percent of its minimum 28 day compressive strength, but in no case sooner than seven days after placement, before rails, tension wires, barbed wire or fabric is installed. Do not stretch and tension fabric and wires and do not hang gates until the concrete has attained its full design strength.

E. Top Rails: Run rail continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.

F. Brace Assemblies: Install braces so posts are plumb when diagonal rods are under proper tension.

G. Tension Wire: Install tension wires by weaving through the fabric and tying to each post with not less than 6 gauge galvanized wire or by securing the wire to the fabric.

H. Fabric: Pull fabric taut and tie to posts, rails and tension wires. Install fabric on security side of fence and anchor to framework so that fabric remains in tension after pulling force is released.

I. Repair damaged coatings in the shop or during field erection by recoating with manufacturer's recommended repair compound, applied per manufacturer's directions.

J. Stretcher Bars: Thread through or clamp to fabric 4-inches on center and secure to posts with metal bands spaced 15-inches on center.

K. Barbed Wire: Install three parallel wires on each extension arm; on security side of fence, unless otherwise indicated. Pull wire taut and fasten securely to each extension arm.

L. Tie Wires: Use U-shaped wire appropriate for the diameter of pipe. Attach pipe and fabric firmly with tie wire ends twisted at least two full turns. Bend ends of wire to minimize hazard to persons or clothing.

M. Fasteners: Install nuts for tension band and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.02 CLEANING

Perform cleaning during installation of the work and upon completion of the work. Remove from site all debris and equipment. Repair all damage resulting from chain link fence system installation. Cleaning shall include appropriate site restoration to its original condition.

END OF SECTION

SECTION 2.8 - CONCRETE AND ACCESSORIES

PART 1 GENERAL

1.01 SCOPE

This Section includes the furnishing, mixing, placing, finishing and curing of concrete structures used for installation of water and sewer line and related appurtenances and for well and wastewater pumping station pads, roads and other associated structures.

1.02 QUALITY ASSURANCE

The Contractor shall carefully inspect all concrete and related products before placement to ensure they are in full compliance with these specifications and all applicable standards.

1.03 DELIVERY AND STORAGE

All materials shall be handled and stored in a safe manner and as required to prevent deformation and exposure to dirt, oil, water and other potentially corrosive or damaging materials.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement for concrete, as specified on the drawings, shall be Portland Cement conforming to ASTM C 150, Type I or Type II. Type III high early-strength cement may be used only with written approval of BCWSS. Use of calcium chloride, chloride ions, or other salts is not permitted.

B. Aggregate shall conform to all requirements of ASTM C 33, No. 57 stone for coarse aggregate and natural sand for fine aggregate. Aggregates containing gypsum or other sulfates are not permitted.

C. Fine aggregates and coarse aggregates from a known source that have performed satisfactorily in concrete may be used in the same proportions previously established.

D. Concrete mix water and ice and curing water shall be clean; clear; and free of oil, acid, alkali, organic materials, or other deleterious substances.

E. Concrete admixtures shall be in accordance with ASTM C 260, ASTM C 494, ASTM C 618 (for fly ash or other pozzolans), and ASTM C 1017.

F. Curing compounds shall be in accordance with ASTM C 309.

G. Curing sheet material shall be white and in accordance with ASTM C 171 and ASTM D 2103.

2.02 CONCRETE MIX

A. Mix concrete in accordance with ASTM C 94.

B. Mix design compressive strength shall be 3,000 psi at 28 days.

C. Maximum size aggregate shall be 1-inch.

D. Air content shall be 4 ½ ± 1 ½ %.

E. Water cement ratio shall not be greater than 0.44.

F. Use accelerating admixtures in cold weather only when approved by BCWSS. Use of admixtures will not relax cold weather placement requirements.

G. Use set-retarding admixtures during hot weather only when approved by BCWSS.

H. Slump shall be 4 inches ± 1 inch.

I. Unit weight shall not be less than 145 lb/ft^3

2.03 FORM MATERIALS

Where needed, forms shall be plywood or other dressed wood material or metal and shall be free of knots, warps or other defects likely to cause irregular surfaces.

2.04 REINFORCING STEEL AND ACCESSORIES

A. Reinforcing Steel shall be in accordance with ASTM A 615, grade 60.

B. Welded Steel Wire Fabric shall be in accordance with ASTM A 185.

C. Stirrup Steel shall be in accordance with ASTM A 82.

D. Tie Wire shall be minimum 16 gage, annealed type.

E. Chairs, Bolsters, Bar Supports, Spacers shall be sized and shaped for strength and support of reinforcement during installation and placement of concrete.

2.05 JOINT FILLER AND SEALERS

Premolded joint filler and joint sealer shall be in accordance with ASTM D 1751 and ASTM D 2103.

2.06 WATERSTOPS

Waterstops shall be polyvinyl chloride ribbed center in accordance with U.S. Army Corps of Engineers Specification CRD-C 572.

2.07 CURING COMPOUNDS

Curing compounds shall be in accordance with ASTM C 309.

2.08 GROUT

A. Masonry Grout

1. Shall have a minimum 28-day compressive strength of 300 psi.

2. Materials

a. Portland Cement: ASTM C-150, Type 1.

b. Fine Aggregate: Sand in accordance with ASTM C-33.

c. Coarse Aggregate: Pea gravel in accordance with ASTM C-33, graded so that at least 90 percent passes 3/8-inch sieve and 90 percent is retained by a No. 4 sieve.

B. Non-Shrink Grout

1. Shall have a minimum 28-day compressive strength of 3,000 psi.

2. Premixed/Preproportioned Grout

a. Five Star Brand Non Shrink Grout or approved equal.

b. Grout shall not contain gypsum, aluminum or iron powders and shall meet the shrinkage requirements of ASTM C-883. Epoxy grout will not be permitted if the substrate is to be exposed to temperatures greater than 140°F.

c. Minimum time of workability shall be 30 minutes at ambient temperature.

d. Application shall be in conformance to manufacturer's specifications.

3. Site Proportioned/Mixed Grout

a. Site mixed grout shall be of "dry pack" or "earthmoist" consistency with 0-1 inch slump. Grout shall consist of three parts sand to one part portland cement with only enough water added to wet all the material.

b. All surfaces shall be cleaned of all dirt and oil prior to application.

c. Prior to placement of grout, the substrate shall be wetted with potable water until saturated without ponding.

d. Grout shall be applied by packing by hand or with the use of a wooden plunger.

C. Flowable Fill Grout: Shall be a mixture of sand, fly ash cement and water that will produce a material that can be used in lieu of compacted soil. Air entrainment may be used up to 30% maximum. The finished product shall have a 28-day compression strength of 500 psi.

PART 3 EXECUTION

3.01 FORMWORK

A. Formwork shall be installed to form the concrete or grout to the applicable lines and grades, to prevent leakage of material to be poured and to withstand loads, pressures and allowable stresses in accordance with ACI 318 and 347R.

B. Tolerances, preparation of form surfaces, removal of forms, and concrete strength at removal shall be in accordance with ACI 117 and 301.

3.02 STEEL REINFORCEMENT

A. Reinforcing shall be accurately installed to the dimensions given on the design drawings, on the approved shop drawings, and as stated in the specifications.

B. The reinforcing shall be securely tied, blocked, and anchored to prevent displacement during concrete placement. Installation shall comply with ACI 301, 315 and 318, and the CRSI Manual of Standard Practice for Reinforced Concrete Construction. Bolster or chair type rebar supports shall be provided to ensure accurate placement and coverage of rebar. No concrete bricks or similar items will be allowed.

C. Splices: Those not shown on drawings shall be subject to BCWSS approval.

D. If concrete cover is not shown on drawings, it shall conform to the requirements of ACI 318.

3.03 ACCESSORIES

A. Joint fillers and/or molded waterstops shall be properly inserted in forms and supported at the locations where called for on the drawings and where required in such manner that it will not become displaced during placing of concrete.

B. Concrete shall be coated with approved bituminous material to prevent bonding

of concrete at step joints and where necessary or required. The bituminous material may also be used for holding joint filler in place.

C. The surface to which sealant is applied shall be clean, dry, sound and free of soil, grease, dirt and loose particles. Sealant shall be mixed and applied according to manufacturer's recommendations.

D. Anchors and inserts shall be firmly positioned so as to prevent displacement during placing of concrete.

E. Curing compound shall be applied to all exposed surfaces with equipment which will produce a fine spray, and all compounds shall be thoroughly agitated just prior to use. The surface shall be sprayed again immediately at right angles to the first application. The rate of each application shall be not less than 1 gallon for each 150 square feet of surface. Care shall be taken to prevent application to joints where concrete bond is required, to reinforcement steel, and to joints where joint sealer is to be placed.

F. No pedestrian or vehicular traffic shall be allowed over the surface for seven days unless the surface is protected by planks, plywood, or a layer of sand at least 1 inch thick. The protection shall not be placed until at least 12 hours after the application of the curing compound.

3.04 CONCRETE INSTALLATION

A. Mass concrete used for bedding, thrust blocks, valves and similar line work facilities shall be prepared and installed as required under the appropriate County Standard Specifications and/or Details for each respective item.

B. Concrete used for replacement of existing pavements shall be prepared and installed in accordance with the applicable County Standard Specifications and/or Details.

C. The following provisions apply to pump station pads, driveways and other structures utilizing reinforced concrete as indicated in the Standard Specifications and/or Details for each respective item, as indicated in the construction drawings or as otherwise directed by BCWSS:

1. Inspection and Preparation

a. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause hardship in placing concrete.

b. A minimum of 24 hours before each concrete placement, provide the ENGINEER with written notification stating the location, date and time of placement.

c. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's instructions.

2. Placement

a. Concrete placement shall be in accordance with ACI 301 and 304R. Do not deposit concrete which has partially hardened or has been contaminated by foreign matter. Remove all temporary spreaders in forms when concrete has reached an elevation rendering their service unnecessary. However, temporary spreaders may remain in place if made of metal or concrete and written approval has been obtained from the BCWSS. The concrete temperature for the slab pour shall not exceed 80°F.

b. The concrete temperature at the time of placement shall be a minimum of 55°F and a maximum of 90°F.

c. All formwork, reinforcing, water stop, and embedments in the form are to be completed or installed and inspected before the placement of concrete is started.

d. Ensure reinforcement, inserts, embedded parts, formed joints and openings are not disturbed during concrete placement.

e. Site-delivered concrete not meeting the requirements of this specification shall be rejected and not used at the site. Rejected concrete trucks shall be at the expense of the Contractor.

f. Place concrete continuously between predetermined construction. Do not break or interrupt successive pours such that cold joints occur.

g. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify BCWSS upon discovery.

h. Adding Water

Adding water to the concrete truck at the site requires the following items:

i. The concrete supervisor is the only individual allowed to direct the driver to add water.

ii. The allowable amount of water, based on the mix design proportions, shall not be exceeded by the addition of water in the field. Record the amount of water added

(gallons) on the batch ticket. The concrete supervisor shall initial and date the batch ticket approving the addition of water.

iii. The addition of water must be made within 45 minutes after the batch ticket time.

iv. After adding water, a minimum of 30 revolutions of the drum at mixing speed is required.

v. After water is added initially to obtain the required slump, additional water is not permitted.

i. Weather Conditions

i. Protection: Do not place concrete when there is an imminent threat of storm or when it is raining, sleeting, or snowing unless adequate protection is provided and approval is obtained from BCWSS. Do not allow rain water to increase mixing water. All surfaces in contact with freshly placed concrete, including reinforcing steel and forms, shall be free from frost and ice.

ii. Cold weather: Do not place concrete when air surrounding concrete is less than 32°F. When the mean daily temperature of air surrounding concrete falls below 40°F, the minimum temperature of concrete when placed shall be 55°F. During cold weather, place concrete in accordance with ACI 306R.

iii. Hot weather: Do not deposit concrete in hot weather when ambient temperature exceeds 85°F. During hot weather, place concrete in accordance with ACI 305R.

j. Curing of concrete to immediately follow finishing operations in accordance with ACI 308 and ACI 318.

3. Finishing

a. Concrete surfaces shall have rough edges tooled-off; irregularities shall be filled pointed-up and spot finished.

b. Slab surfaces shall be floated, straightened with straightedge as necessary, and finished with steel trowels. Surfaces of external slabs shall have a very light brown finish.

4. Protection

   a. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

   b. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

5. Testing

   a. Compressive Strength Test

      i. Specimens to be prepared on site.

      ii. Each compressive strength test will consist of six (6) cylinders: two tested at seven days, two tested at 28 days and two held in reserve. One strength test shall be made per each 50 yd^3 usage or, when a day's usage is less than 50 yd^3, from each day's usage. Specimens will be secured in accordance with ASTM C 172, made and cured in accordance with ASTM C 31, and tested in accordance with ASTM C 39.

   b. Slump Test: For each truck load of concrete, one slump test will be made in accordance with ASTM C 143.

   c. Air Test: For each truck load of concrete, one air content test will be made in accordance with ASTM C 231.

   d. Temperature: Measure and record temperature of concrete for every batch placed and with each set of compression cylinders taken.

   e. All test/measurement results will be reported in writing to BCWSS. Contractor shall retain records of all specimens to include detailed location of each pour represented.

3.05 GROUT INSTALLATION

A. Masonry grout shall be mixed and placed in accordance with NCMA, "Specification for the Design and Construction of Load-Bearing Concrete Masonry, Chapter 4 .

B. Flowable fill shall be used to fill unused casings or fill in narrow trenches that are difficult to compact backfill. Contractor shall submit mix design for approval by BCWSS.

C. Non-shrink grout shall be used for column bases or under equipment bases. Non-shrink grout shall be placed by packing by hand or with a wooden plunger.

D. Mix grout as close to WORK area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials. Do not mix more grout than can be placed within 20 minutes.

E. Installation methods and procedures shall be as recommended by manufacturer and/or as approved by BCWSS before work is begun.

F. Type of grout and method of installation for Tunneling, Boring and Jacking shall be furnished to BCWSS for review and approval prior to use in construction operation.

G. Cure exposed grout for 3 days after placing by keeping wet or coating with a curing compound.

3.06 PATCHING AND DEFECTS

A. Defects in formed concrete surfaces shall be repaired within 24 hours of placement, to the satisfaction of BCWSS, and defective concrete shall be replaced within 48 hours after the adjacent forms have been removed. All concrete which is honeycombed or otherwise defective shall be cut out and removed to sound concrete, with edges square cut to avoid feathering.

B. Except as modified herein, concrete repair work shall conform to Chapter 9 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. All repair work shall be adequately cured.

C. Where authorized by BCWSS, repair may be accomplished by patching conducted as specified herein. However, permission to patch shall not waive the BCWSS 's right to have the defective work completely removed if the patch or repairs do not, in BCWSS's opinion, satisfactorily restore the quality and appearance of the work. Patching shall be conducted as follows:

1. Chip away defective areas at least 1-1/2 inch deep perpendicular to the surface, wet the area and 6 inches around it to prevent absorption of water from patching mortar, and brush a sand-cement grout consisting of one part fine aggregate to one part portland cement onto the surface.

2. Masonry grout shall be used for patching. Use the minimum amount of mixing water required for placing.

END OF SECTION

END OF ARTICLE 2

ARTICLE 3

STANDARD SPECIFICATIONS FOR WATER SYSTEM CONSTRUCTION

SECTION 3.1 - WATER MAINS AND ACCESSORIES

PART 1 GENERAL

1.01 SCOPE

A. This Section describes products to be incorporated into the water mains and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.

B. Supply all products and perform all work in accordance with applicable Water Standards. Latest revisions of all standards are applicable.

1.02 QUALIFICATIONS

A. If requested by the County, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

B. All products shall be cast, fabricated, assembled and manufactured in the United States of America.

C. All materials used and which come in contact with drinking water must meet NSF Standard 61 for potable water use.

1.03 TRANSPORTATION AND HANDLING

Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories in accordance with manufacturer's written instructions. Make equipment available at all times for use in unloading.

1.04 STORAGE AND PROTECTION

Store and protect all pipe and accessories which cannot be distributed along the route. Store all pipe and accessories in accordance with manufacturer's written instructions.

PART 2 PRODUCTS

2.01 PIPING MATERIALS AND ACCESSORIES

A. Ductile Iron Pipe (DIP): All water mains larger than 6 inches shall be DIP. Pipe shall be manufactured by American Cast Iron Pipe Company (ACIPCO), U.S. Pipe, or as approved by OCWRD.

1. Ductile iron pipe shall conform to the latest requirements of AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet and shall have a minimum pressure rating as indicated in the following table:

Pipe Size (inches)	Pressure Class (psi)
4 - 12	350
14 - 20	300
24	250

Where system hydraulic pressure exceeds rated pipe working pressure and/or depth of cover exceeds maximum depth of cover per AWWA C151, the required pipe class shall be determined by a licensed Professional Engineer.

2. Flanged pipe minimum wall thickness shall be equal to Special Thickness Class 53. Flanges shall be provided by the pipe manufacturer with the pipe or fittings.

3. The weight, casting period and class or nominal thickness shall be showed on each pipe. The manufacturer's mark, the year in which the pipe is produced and the letters "DI" or "DUCTILE IRON" shall be clear and legible, and all cast marks shall be on or near the bell.

4. Pipe and fittings shall be cement lined in accordance with AWWA C104 and be furnished with a bituminous outside coating.

5. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum rated working pressure of 250 psi.

6. Joints

a. Unless shown or specified otherwise, joints 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 AWWA C111.

b. Restrained joints: Restrained joints shall be manufactured restrained joint or restraining gasket joint as specified below:

i. Manufactured restrained joints shall be American FLEX-RING or LOK-RING, or U.S. Pipe TR FLEX.

ii. Restraining gasket joints shall be for pipes no larger than 12-inches in diameter and assembled with American FAST- GRIP, or US Pipe FIELD-LOK gasket.

iii. No field welding for manufactured restrained joint pipe assembly will be permitted. Where field cutting of restrained joint pipe is required, the joint may be assembled with American FIELD FLEX-RING or US Pipe TR FLEX GRIPPER RINGS.

c. Flanged joints shall meet the requirements of ANSI B16.1, Class 125.

7. Provide the appropriate gaskets for mechanical and flange joints. Gaskets for flange joints shall be made of 1/8-inch thick, cloth reinforced rubber; gaskets may be ring type or full face type.

8. Bolts and Nuts

a. 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.

b. Bolts and nuts for mechanical joints shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.

c. 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.

d. 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.

e. 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.

9. Mechanical joint glands shall be ductile iron.

10. Ductile iron pipe shall be encased with polyethylene film where shown on the Drawings. Polyethylene film shall meet the requirements of AWWA C 105.

11. Pipe bosses shall be welded-on ductile iron body type and shall be faced and tapped for AWWA C110 flange connection. All welding, fabrication and outlet hole drilling shall be performed by the manufacturer. Outlets shall be free of burrs. The bosses shall be welded on minimum Thickness Class 51 ductile iron pipe.

12. Thrust collars shall be welded-on ductile iron body type designed to withstand thrust due to 250 psi internal pressure on a dead end.

13. Acceptance will be on the basis of the County's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

14. Field Locks shall be used on bores with casing pipe installed.

15. Detection tape shall be provided over all DIP water mains.

B. Polyvinyl Chloride Pipe (PVC)

1. All PVC pipe shall have belled ends for push-on jointing and shall be Pressure Class 235 (DR 18) conforming to AWWA C900, ductile iron pipe equivalent outside diameters.

2. PVC pipe shall be supplied in 20 foot nominal length.

3. All PVC pipe shall bear the National Sanitation Foundation (NSF) seal of approval for potable water use, and comply with requirements for Type 1, Grade 1 of ASTM D1784 and D2241.

4. All PVC pipe shall be marked at intervals of not more than five feet with the above-mentioned ratings all in accordance with AWWA Standard C900.

5. Joints for PVC force mains shall have integral bell and spigot type joints with elastomeric gaskets having the capability of absorbing expansion and contraction without leakage. Joints shall meet the requirements of ASTM D 3139; gaskets shall meet the requirements of ASTM F 477. Joint system shall be subject to the approval of the County and shall be identical for pipe and fittings.

6. All PVC pipe shall be of one manufacturer, the Contractor shall not mix pipe from more than one manufacturer.

7. Fittings for PVC pipe of 2-1/2-inches nominal diameter and smaller shall be polyvinyl chloride push-on fittings supplied by the manufacturer of the

PVC pipe used. Ninety-degree turns shall be made with 90 degree “long sweep” elbows or bends.

8. Fittings for PVC pipe 3-inches nominal diameter or larger shall be mechanical joint ductile iron fittings as specified for ductile iron pipe. Fittings shall be supplied with rubber adaptor rings designed for the specific purpose of jointing to PVC pipe.

9. All fittings, glands and gaskets shall be American made. Any foreign made fittings, glands or gaskets installed by the Contractor shall be removed and replaced at the Contractor’s expense.

10. A #14 AWG copper tracer wire shall be provided and attached to all PVC water mains.

11. Acceptance will be on the basis of the BCWSS’s inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation.

C. Service Line

1. Service lines shall be copper pipe or tubing manufactured and furnished in accordance with ASTM B88, Type "K" Soft Temper.

2. Fittings and adapters shall be cast bronze, compression type connection, equal to Mueller Style 110 or Dresser Style 88.

D. 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, "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 2 inches when buried less than 10 inches below the surface. Tape width shall be a minimum of 3 inches when buried greater than 10 inches and less than 20 inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

2.02 GATE VALVES

A. All gate valves shall operate such that hand-wheel rotation to the left (counter-clockwise) opens the valve.

B. Non-Buried Service: 3-Inches in diameter and smaller gate valves for non- buried service shall be bronze, heavy duty, rising stem, wedge type with screwed or union bonnet. Valve ends shall be threaded or flanged type as appropriate. Valves shall have a minimum 200 psi working pressure for water (125 psi working pressure for steam). Gate valves shall be equal to Crane No. 428.

C. Buried Service: Gate valves for buried service shall be resilient wedge type conforming to the requirements of AWWA C509 or AWWA C515 rated for 200 psi working pressure. Valve ends shall be mechanical joint type.

1. Valves shall be provided with two O-ring stem seals with one O-ring located above and one O-ring below the stem collar. The area between the O-rings shall be filled with lubricant to provide lubrication to the thrust collar bearing surfaces each time the valve is operated. At least one anti-friction washer shall be utilized to further minimize operating torque. All seals between valve parts, such as body and bonnet, bonnet and bonnet cover, shall be flat gaskets or O-rings.

2. The valve gate shall be made of cast iron having a vulcanized, synthetic rubber coating, or a seat ring attached to the disc with retaining screws. Sliding of the rubber on the seating surfaces to compress the rubber will not be allowed. The design shall be such that compression-set of the rubber shall not affect the ability of the valve to seal when pressure is applied to either side of the gate. The sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

3. All internal ferrous surfaces shall be coated with epoxy to a minimum thickness of 4 mils. The epoxy shall be non-toxic, impart no taste to the water and shall conform to AWWA C550, latest revision.

4. Gate valves shall be manufactured by Mueller or M & H Valve.

2.03 FIRE HYDRANTS

A. All fire hydrants shall conform to the requirements of AWWA C502 with a minimum 150 psi working pressure. Hydrants shall be the compression type, closing with line pressure. The valve opening shall not be less than 5-1/4 inches.

B. In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.

C. The means for attaching the barrel to the standpipe shall permit facing the hydrant a minimum of eight different directions.

D. Hydrants shall be fully bronze mounted with all working parts of bronze. Valve seat ring shall be bronze and shall screw into a bronze retainer.

E. All working parts, including the seat ring shall be removable through the top without disturbing the barrel of the hydrant.

F. The operating nut shall match those on the existing hydrants. The operating threads shall be totally enclosed in an operating chamber, separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by grease or an oil reservoir.

G. Hydrant shall be a non-freezing design and be provided with a simple, positive, and automatic drain which shall be fully closed whenever the main valve is opened.

H. Hose and pumper connections shall be breech-locked, pinned, or threaded and pinned to seal them into the hydrant barrel. Each hydrant shall have two 2-1/2-inch hose connections and one 5-1/4-inch pumper connection, all with National Standard threads and each equipped with cap and non-kinking chain.

I. Hydrants shall be furnished with a mechanical joint connection to the spigot of the 6-inch hydrant lead.

J. Minimum depth of bury shall be 4.5 feet. Provide extension section where necessary for proper vertical installation and in accordance with manufacturer's recommendations.

K. All outside surfaces of the barrel above grade shall be painted silver with enamel equal to Koppers Glamortex 501.

L. Hydrants shall be traffic model and shall be Mueller Super Centurion or M & H Model 129.

M. Provide the County with one adjustable fire hydrant wrench for every accepted water system.

N. Hydrants must be marked on the road with a blue road reflector.

2.04 VALVE BOXES AND EXTENSION STEMS

A. All buried valves shall be equipped with valve boxes. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5.25 inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6 inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have "WATER VALVE" or "WATER" cast into them. Valve boxes shall be manufactured in the United States.

B. All valves shall be furnished with extension stems, as necessary, to bring the operating nut to within 30 inches of the top of the valve box. Connection to the valve shall be with a wrench nut coupling and a set screw to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller A-26441 or M & H Valve Style 3801.

2.05 VALVE MARKERS

A. The Contractor shall provide a fiberglass valve marker for each valve installed. The marker shall be a fiber reinforced composite material with an ultraviolet light inhibitor and curved cross section with a minimum dimension of 3.75-inches wide. The post design shall be capable of flattening out when hit and then returning to its normal upright position. The marker shall be installed according to manufacturer's specifications. The decal shall be placed on the side of the marker which is facing the roadway.

B. Valve markers shall be Rhino FiberCurve™ Fiberglass Utility Marking Post with PolyTech Coating™ or a BCWSA approved equal. The valve markers shall be blue and 66-inches in length. Each valve marker shall have the TriView Marking System decal #GD8-5194K.

2.06 TAPPING SLEEVES AND VALVES

A. Tapping sleeves shall be cast or ductile iron of the split-sleeve, mechanical joint type. The Contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve. 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 and valve shall be supplied by the valve manufacturer. Tapping sleeves shall be equal to American-Darling, Mueller or M & H Valve.

B. Tapping sleeves for PVC pipe shall be fabricated of stainless steel, and shall be clamp-on type, equal to Smith-Blair, Ford or Romac Industries, Inc.

2.07 TAPPING SADDLES

Tapping saddles shall be ductile iron body type with O-ring gasket and alloy steel straps. Connection shall be flanged or mechanical joint. Tapping saddles shall be equal to ACIPCO A-10920 and ACIPCO A-30920.

2.08 SERVICE SADDLES

A. Service saddles for water service connections to PVC pipe shall be heavy, cast bronze, two-piece design for controlled diameter. Tap shall be AWWA tapered thread.

B. Service saddles shall be equal to AY McDonald Series 3891 2"x3/4". For water service connections to cast or ductile iron pipe, saddles shall be equal to Smith-Blair Series 317 or Ford Style F202.

2.09 CORPORATION AND CURB STOPS

Corporation and curb stops shall be ground key or ball valve type, shall be made of bronze conforming to ASTM B 61 or B 62, and shall be suitable for the working pressure of the system. Ends shall be suitable for tube compression type joint. Threaded ends for inlet and outlet of corporation stops shall conform to AWWA C800; coupling nut for connection to tubing shall conform to ANSI B16.26. Corporation or curb stops shall be manufactured by Mueller or Ford.

2.10 BACKFLOW PREVENTERS

Backflow prevention devices shall be provided subject to customer type and degree of potential cross-connection hazard as follows:

A. Residential Services: Individual residential services represent relatively low hazard conditions and, therefore, shall be provided with a Dual Check Valve (DuC) assembly. The assembly shall be constructed of cast bronze body with plastic check modules, silicone disc and buna N seals, and stainless steel springs. The assembly shall be rated for a minimum 150 psi working pressure meeting AWWA requirements and have UL/FM rating. Assemblies shall be manufactured by Watts, Febco or Ames.

B. Commercial and Institutional Services: Commercial and institutional customers represent relatively low hazard conditions with potential for back pressure and back siphonage into the distribution system. These services shall be provided with a Double Check Valve Assembly (DCV): The assembly shall be constructed of epoxy-coated ductile iron valve bodies with removable seats and stainless steel trim. The assembly shall contain two independent check valves, each equipped with bronze ball valve type test ports. The assembly shall be furnished with two resilient seated isolation gate valves equal to those specified herein. The gate valves shall be equipped with OS&Y handwheel operators. The assembly shall be rated for a minimum 175 psi working pressure. Joints shall be flanged, Class 125. The assembly shall meet AWWA C510 and have UL/FM rating. The assembly shall be equipped with detector assembly for detection of unauthorized water use. DCV assemblies shall be manufactured by Watts, Febco or Ames.

C. Industrial and Commercial/Multi-Family Irrigation and Fire Protection Services: These customers represent high risk of potential for contamination and shall be provided with a Reduced Pressure Zone Assembly (RPZ) assembly. The assembly shall be constructed of fused epoxy coated cast iron check valve body with replaceable bronze seats, epoxy coated cast iron relief valve with stainless steel trim. The assembly shall be furnished with two resilient seated isolation gate valves equal to those specified herein. The gate valves shall be equipped with OS&Y handwheel operator. The assembly shall be rated for a minimum 175 psi working pressure. Joints shall be flanged, Class 125. The assembly shall meet AWWA C511 and have UL/FM rating. RPZ assemblies shall be manufactured by Watts, Febco or Ames.

2.11 WATER METER

All water meters shall be purchased through BCWSS.

2.12 ALTITUDE VALVE

A. Altitude control valve shall be of the single acting type, hydraulically-operated, diaphragm-actuated, pilot-controlled, globe type body. The valve shall close off tightly when the water reaches a maximum pre-determined level in the tank to prevent overflow. The valve shall not re-open to refill the tank until the water level drops a specified amount as adjusted on a differential control pilot valve.

B. Valve closing speed shall be adjustable. The tank water level control shall be by means of a diaphragm-operated, spring-loaded, three-way pilot valve which senses the difference between the static force in the tank and the adjustable spring load. This is done by means of a sensing line between the tank and the pilot control.

C. Valves shall be furnished with all exterior piping, fittings, wye strainers and ball valves. Wye strainers shall be equipped with ball type, blow-off valves for strainer flushing without removing line pressure. Top cover shall be equipped with blow-off valve for air release without removing line pressure.

D. Main valve body shall be constructed of high tensile cast or ductile iron. Main valve trim shall be brass and stainless steel. Altitude control shall be high tensile cast iron with brass and stainless steel trim. All internal hardware shall be brass or stainless steel. Diaphragms shall be nylon fabric with Buna-N coating. O-rings shall be Buna-N. Valves shall be furnished with Class 125 flange ends and be designed for 150 psi working pressure. Valves shall be serviceable in-place by removal of top cover. All internal parts, O-rings and valve seats shall be replaceable through top cover.

E. Altitude valves shall be manufactured by Watts, Ames or Cla Val.

2.13 MANHOLES AND PRECAST CONCRETE VAULTS

Manholes and vaults shall consist of precast reinforced concrete sections, a conical or flat slab top section, a base section and access frame with cover or hatch conforming with the Standard Details and the following requirements:

A. Precast Concrete Sections

1. Precast manhole concrete sections shall be manufactured, tested and marked in accordance with latest provisions of ASTM C 478.

2. Precast concrete sections for utility vaults and other water system structures shall be manufactured, tested and marked in accordance with ASTM C 858 and ASTM C 913.

3. Ends of each reinforced concrete riser section and bottom end of top section shall be so formed that when the risers and top are assembled, they make a continuous and uniform structure.

4. Transition slabs which convert bases larger than four feet in diameter to four foot diameter risers shall be designed by the precast concrete manufacturer to carry the live and dead loads exerted on the slab.

5. Joints of sections shall be of tongue and groove type. Sections shall be joined using a preformed butyl joint sealant conforming to applicable provisions of ASTM C 990. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS 202.

6. Each manhole section shall have not more than two holes for the purpose of handling and laying. The number of holes in vault sections should be limited to only those required to properly and safely handle and lay each particular section piece. These holes shall be tapered and shall be plugged with rubber stoppers or grout after installation.

7. Holes in precast bases or sections to receive pipes shall be provided with flexible manhole sleeves of high quality synthetic rubber.

B. Brick and Mortar: Brick shall be whole and hardburned, conforming to ASTM C 32, Grade MS. Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150. Sand shall meet ASTM C 144.

C. Manhole Frames and Covers

1. Manhole frames and covers shall be cast iron conforming to minimum requirements of latest ASTM A 48, for Class 35B Gray Iron Castings. Castings shall be made accurately to required dimensions, fully interchangeable, sound, smooth, clean and free from blisters or other defects. Defective castings which have been plugged or otherwise treated shall not be used. Each casting shall have its actual weight in pounds stenciled or painted on it in white paint.

2. Manholes frames and covers shall be of size and location as shown on the Standard Details. Where manholes or vaults are to located under roads or driveways, whether paved or unpaved, frames and covers shall be traffic rated equal to model V-1357 by EJ.

D. Vault Floor Doors

1. Door shall be single or double leaf type as approved by the County.

2. The frame shall be 1/4-inch extruded aluminum alloy 6063-T6, with built-in neoprene cushion and with strap anchors bolted to the exterior. Door leaf shall be 1/4-inch aluminum diamond plate, alloy 6061-T6, reinforced with aluminum stiffeners as required. Stainless steel hinges shall be bolted to the underside and pivot on torsion bars that counterbalance the door for easy operation. The door shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release the cover for closing. The door shall be built to withstand a live load of 150 pounds per square foot, and shall be equipped with a snap lock and removable handle. Bituminous coating shall be applied to exterior of frame by the manufacturer. The door shall also be provided with a hasp and padlock in addition to the built-in locking mechanism. Padlocks for all doors shall be keyed alike.

3. The floor door shall be Type K, equal to The Bilco Company, Halliday Products or Thompson Fabricating Company "TuffHatch".

2.14 RETAINER GLANDS AND FLANGE ADAPTERS

A. Retainer glands shall be Megalug Series 1100, as manufactured by EBAA Iron, or Uni-Flange Series 1400, as manufactured by Ford Meter Box Company.

B. Flange Adapter: Flange adapters shall permit the connection of unthreaded, ungrooved, open-ended, ductile iron pipe to ANSI/ASME B16.1, Class 125 flanges. Flange adapters shall meet the test requirements of ANSI/ASME B16.1 for Class 125 flanges. The adapter shall be a ductile iron casting incorporating a flange with extended throat, set screws and gasket. The gasket shall provide a compression seal between the adapter, the pipe and the adjacent flange. Flange adapters are to be used only in locations specifically approved by the County and in accordance with the manufacturer's recommendations. Flange adapters shall be manufactured by Uni-Flange (Series 400) or EBAA Iron.

2.15 HYDRANT TEES

Hydrant tees shall be equal to ACIPCO A10180 or U.S. Pipe U-592.

2.16 ANCHOR COUPLINGS

Lengths and sizes shall be as approved by the County. Anchor couplings shall be equal to ACIPCO A 10895 or U.S. Pipe U-591.

2.17 VALVE KEYS

A. Valve keys shall be 72-inches long with a tee handle and a 2-inch square wrench nut. Valve keys shall be furnished by the valve manufacturer. Valve keys shall be equal to Mueller A-24610 or ACIPCO No. 1303.

B. The Contractor shall provide to the County new valve keys in accordance with the following schedule:

No. of Valves Installed	No. of Keys to County
1 - 10	1
11 - 20	2
21 or more	3

PART 3 EXECUTION

3.01 EXISTING UTILITIES AND OBSTRUCTIONS

A. The Contractor shall call the Utilities Protection Center (UPC) (811) as required by Georgia law (Code Section 25-9-1 through 25-9-13) and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site at least 72 hours (three 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. 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 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. Expose the facility for a distance of at least 200 feet in advance of pipeline construction to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.

3. Avoid utility damage and interruption by protection with means or methods recommended by the utility owner.

4. 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.

C. Conflicts 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.

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 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.

D. Electronic Locator: 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 Separation

1. There shall be no physical connections between a public or private potable water supply system and a sewer, or appurtenances, which would permit the passage of any sewage or polluted water into the potable supply. No water pipes shall pass through or contact any part of a sewer manhole.

2. Water mains should maintain a minimum 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 10 foot separation, OCWRD may reduce this distance provided the water main be placed in a separate trench or undisturbed earth shelf with a minimum of 18 inches of vertical separation between the bottom of the water main to 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 18 inches.

3. The water main, when installed below the sewer, shall be encased either in a watertight casing pipe or in concrete with a minimum 6 inch concrete depth to the first joint in each direction. The encasement shall extend 10 feet on both sides of the crossing. 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.

3.02 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS

A. Install pipe lines and appurtenances along highways, streets and roadways in accordance with the applicable regulations of, and permits issued by, the Department of Transportation and Oconee County with reference to construction operations, safety, traffic control, road maintenance and repair.

B. Traffic Control

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 Georgia DOT 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 the Georgia Department of Transportation and Barrow County a minimum of 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 the Georgia Department of Transportation and Oconee 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 current "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. 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, strip and stockpile all sod, topsoil and other material suitable for right-of-way restoration.

3. Trenching, Laying and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.

4. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod and any other materials removed from shoulders.

5. Construction operations shall be limited to 400 feet along areas, including clean-up and utility exploration.

D. Excavated Materials: Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off of the pavement in a timely manner.

E. Drainage Structures: 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.

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 re-establishing these features.

G. Maintaining Highways, Streets, Roadways and Driveways

1. 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, 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. 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. Immediately repair all driveways that are cut or damaged. 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 will not interfere with traffic.

B. No street or roadway may 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.

C. No distributed pipe shall be placed inside drainage ditches.

D. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.

3.04 LAYING AND JOINTING PIPE AND ACCESSORIES

A. Lay all pipe and fittings to accurately conform to the lines and grades approved by the County. Mains shall be installed after concrete curb has been installed for roadways through developments.

B. Pipe Installation

1. Installation of ductile iron water mains and their appurtenances shall be per AWWA C600 (latest edition) and underground installation of polyvinyl chloride (PVC) pressure pipe and fittings for water shall be per AWWA C605 (latest edition), unless stated otherwise in this Section.

2. 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.

3. All pipe, fittings, valves, hydrants and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by OCWRD, who may prescribe corrective repairs or reject the materials.

4. 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.

5. 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.

6. 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.

7. 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.

8. Provide detection tape for all pipe. Detection tape shall be buried 4 to 10 inches deep. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20 inches from the finish grade surface.

9. Provide copper wire for all PVC pipe. Copper wire shall be attached along the length of the pipe.

C. Alignment and Gradient

1. Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.

2. Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint.

E. Joint Assembly

1. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.

2. Each restrained joint shall be inspected by the Contractor to ensure that it has been "homed" 100 percent.

F. Cutting Pipe: Cut ductile iron pipe using an abrasive wheel saw. 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: Polyethylene encasement shall be used where water line is within 10 feet horizontally of a steel gas line, to include each side of a water main's crossing of/by a steel gas line. Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired.

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 corrected or held for inspection by the County. 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 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 will 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 will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 30 inches beneath finished grade so as to set the top of the operating nut 30 inches below finished grade. The valve box cover shall be flush with the surface of the finished area.

4. No new valve boxes shall be located within a sidewalk or pavement.

5. In no case shall valves be used to bring misaligned pipe into alignment during installation.

6. A valve marker and reflector as advised by the OCWRD inspector shall be provided for each underground valve. Valve markers shall be installed 6 inches inside the right-of-way or easement.

7. All fittings shall be installed with retainer glands as well as thrust blocking in accordance with Article 3.05 of this Section.

I. Hydrant Installation and Spacing

1. Prior to installation, inspect all hydrants for direction of opening, nozzle threading, operating nut and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, handling damage and cracks. Defective hydrants shall be corrected.

2. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the roadway, with pumper nozzle facing the roadway.

3. Hydrants shall be set to the established grade, with the centerline of the lowest nozzle at least 18 inches above the ground and no more than 24” above finished grade.

4. Each hydrant shall be connected to the main with a 6-inch branch controlled by an independent 6-inch valve. When a hydrant is set in soil

that is pervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least 6 inches above the drain port opening in the hydrant to a distance of 12 inches around the elbow.

5. A drainage pit 2 ft x 2 ft x 2 ft shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand under and around the elbow of the hydrant and to a level of 6 inches above the drain port.

6. Hydrants shall be located as approved by the County. In the case of hydrants that are intended to fail at the ground-line joint upon vehicle impact, specific care must be taken to provide adequate soil resistance to avoid transmitting shock moment to the lower barrel and inlet connection. In loose or poor load bearing soil, this may be accomplished by pouring a concrete collar approximately 6 inches thick to a diameter of 24 inches at or near the ground line around the hydrant barrel.

J. Vaults

1. Construct the vault or manhole as approved by the County.

2. The floor door shall be cast into the top slab. The floor door drain shall be piped to vault exterior to "daylight".

3. Manholes shall be constructed such that their walls are plumb.

3.05 CONNECTIONS TO WATER MAINS

A. Make connections to existing pipe lines with tapping sleeves and valves.

B. Location: Before laying pipe, locate the points of connection to existing water mains and uncover as necessary to confirm the nature of the connection to be made.

C. Interruption of Services: Make connections to existing water mains only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the County.

D. Tapping Saddles and 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 the saddle or 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 saddle or sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with water. An air compressor shall be attached, which will induce a test pressure as specified in this Section. No leakage shall be permitted for a period of five minutes.

4. After attaching the saddle or 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 percent hypochlorite solution.

E. Connections Using Solid Sleeves: Where connections are approved by the County 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 approved by the County 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.

3.06 THRUST RESTRAINT

A. Provide restraint at all points where hydraulic thrust may develop.

B. Retainer Glands: Provide retainer glands where approved by the County. 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 which do not have inherent torque indicators.

C. Harnessing

1. Provide harness rods only where specifically approved by the County.

2. Harness rods shall be manufactured in accordance with ASTM A 36 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, provide 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. Hydrants: Hydrants shall be attached to the water main by the following method:

1. For mains 12-inches and smaller, the isolation valve shall be attached to the main by connecting the valve to the hydrant tee.

2. The isolation valve shall be attached to the hydrant by providing an anchor coupling between the valve and hydrant, if the hydrant and valve are less than two feet apart. Otherwise, provide ductile iron pipe with retainer glands on the hydrant and valve.

E. Thrust Collars: Collars shall be constructed as approved by the County. Concrete and reinforcing steel shall meet the requirements as specified in this Section. The welded-on collar shall be designed to meet the minimum allowable load. The welded-on collar shall be attached to the pipe by the pipe manufacturer.

3.07 INSPECTION AND TESTING

A. All sections of the water main subject to internal pressure shall be pressure tested. A section of main will be considered ready for testing after completion of all thrust restraint and backfilling.

B. Each segment of water main between main valves shall be tested individually.

C. Test Preparation

1. Water mains to be tested shall be thoroughly flushed at flow velocities of at least 2.5 feet per second or higher in order to adequately remove debris from pipe and valve seats. Partially open valves to allow the water to flush the valve seat.

2. Partially operate valves and hydrants to clean out seats.

3. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.

4. All stubouts shall be flushed and included in the pressure testing. Stubout valves shall be open during pressure testing.

5. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Insert corporation cocks at highpoints to expel air as main is filled with water as necessary to supplement automatic air valves.

6. For the section of main installed at the entrance of the development, the test tap shall be place at the development entrance housed inside a service box and buried for future use by an entrance irrigation meter.

7. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure.

8. The differential pressure across a valve or hydrant shall equal the maximum possible, but not exceed the rated working pressure. Where necessary, provide temporary backpressure to meet the differential pressure restrictions.

9. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure.

D. Test Pressure

1. Test the pipeline at 200 psi as measured at the lowest elevation of the test section for at least two hours.

2. Maintain the test pressure within 5 psi of the specified test pressure 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 greater than 5 psi.

E. Leakage

1. Leakage shall be defined as the sum of the quantity of water that must be pumped into the test section, 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.

2. Leakage through existing valves shall not relieve the Contractor from successfully completing the leakage test.

3. Test Results: No test section shall be accepted if the leakage exceeds the limits determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{133{,}200}$$ for ductile iron pipe (per AWWA C600)

$$L = \frac{SD(P)^{1/2}}{148{,}000}$$ for PVC pipe (per AWWA C605)

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 test pressure during the leakage test, in pounds per square inch (gauge)

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.

F. The County shall provide water for all flushing and testing of the water lines at no cost to the Contractor. All water shall be metered by a County-supplied hydrant meter.

G. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.

3.08 DISINFECTING PIPELINE

A. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method and these Specifications.

B. Chlorination

1. Apply chlorine solution to achieve a concentration of at least 25 milligrams per liter free chlorine in new line. Retain chlorinated water for 24 hours.

2. Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the 24 hour period. Operate all valves and hydrants.

3. After 24 hours, all samples of water shall contain at least 10 milligrams per liter free chlorine. Re-chlorinate if required results are not obtained on all samples.

C. Disposal of Chlorinated Water: Reduce chlorine residual of disinfection water to less than one milligram per liter if discharged directly to a body of water or to less than two milligrams per liter if discharged onto the ground prior to disposal. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. Flush all lines until residual is equal to existing system.

D. Bacteriological Testing: After final flushing and before the water main is placed in service, the Contractor shall collect samples from the line and have tested for bacteriological quality in accordance with the rules of the Georgia Department of Natural Resources, Environmental Protection Division. Testing shall be performed by a laboratory certified by the State of Georgia. Re-chlorinate lines until required results are obtained.

3.09 PROTECTION AND RESTORATION OF WORK AREA

A. General: 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 started.

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 Department of Transportation's engineer 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: 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: Do not disturb cultivated trees or shrubbery unless approved by the County. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.

D. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 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 work area and disposed of by the Contractor. No stumps, wood piles, or trash piles will be permitted on the work site.

E. Disposal of Rubbish: Dispose of all materials cleared and grubbed during the construction of the Project in accordance with the applicable codes and rules of the appropriate county, state and federal regulatory agencies.

F. Swamps and Other Wetlands

1. The Contractor shall not construct permanent roadbeds, berms, drainage structures or any other structures which alter the original topographic features within the easement.

2. All temporary construction or alterations to the original topography will incorporate measures to prevent erosion into the surrounding swamp or 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 which 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.

END OF SECTION

SECTION 3.2 - WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.01 SCOPE

A. The work covered by this Section includes furnishing all materials and equipment, providing all required labor and installing water service connections and all appurtenant work according to these Specifications and/or to the Water Connection Detail as shown schematically on the Standard Detail Drawings.

B. Water meters are not to be furnished nor installed. However, the water meter connection must be compatible with the water meters currently used by the County.

1.02 LOCATIONS

Locations shall be directed by the County along the route of the water mains.

1.03 SERVICE COMPATIBILITY

A. It is the intent of these Specifications that the water service connections shall duplicate those presently being provided by the County in order to be compatible with their service maintenance procedures.

B. Water Service Connections include tapping saddle on all sizes of mains, 3/4-inch corporation stop at the main, 3/4-inch diameter service pipe from main to meter, 3/4-inch meter, 3/4-inch curb stop, meter box and all fittings through the outlet of the service line at the meter.

1.04 QUALITY CONTROL

All materials installed under this Section shall have the approval of the NSF for water services.

PART 2 PRODUCTS

2.01 SERVICE LINE

A. Copper Tubing: Tubing shall be ASTM B88, Type K. Fittings shall be brass with compression connection inlets and outlets, ANSI B16.26.

B. Where required, adaptors shall be brass ANSI B16.18. Unions shall be cast bronze. Joints shall be compression type. All fittings shall be of bronze construction with compression type connection. Copper tubing shall be used from the new water main to the new meter box and between the meter boxes as shown on the Drawings.

C. Corporation Stop shall be 3/4” minimum, bronze with compression joint; Ford Model F1000, pack joint for copper or plastic pipe or a BCWSS approved equal.

D. Curb Stop shall be Ford Model B-44-333MW with padlock wings; curb stop shall be located inside the meter box or a BCWSS approved.

E. Insert Stiffeners for 3/4” tubing and/or pipe shall be stainless steel, Ford Model 51 or a BCWSS approved equal.

F. 3/4" Ball Valve shall be WATTS Model 600 or a BCWSS approved equal.

G. 3/4" x 6” Brass Nipple with Male Ends.

H. Tapping Saddle Clamp for connecting to Water Mains shall be Ford Model S90 for 2” pipe size, Ford Model 202BS for 4” and larger pipe sizes or a BCWSS approved equal.

I. Detection tape shall be provided over all service lines.

2.02 METER BOX

A. Meter boxes placed in natural ground shall be plastic. Material shall meet or exceed the following:

1. Tensile Strength: 3,400 psi (ASTM D 638).

2. Flexural Modulus: 191,000 psi (ASTM D 790).

3. Impact Strength, Izod: 0.6-feet 16/inch (ASTM D 256).

4. Deflection Temperatures: 200 degrees F (ASTM D 648).

B. Plastic meter boxes shall be equal to DFW Plastics, Inc., Model DFW1200TT.

C. Meter box shall be fitted with plastic touch reader cover equal to DFW Plastics, Inc. Model DFW1200-1.

D. Minimum dimensions shall be 12-5/16 x 17 9/16 inches top and 21-13/16 x 16-9/16 inches at bottom and 12 inches deep.

E. Once the meter box is in place it shall be marked with 2” PVC painted blue on the top. “W” shall be cut in the curb to indicate water.

F. Meter boxes placed in concrete/asphalt or high traffic areas shall be traffic rated and approved by BCWSS.

PART 3 EXECUTION

3.01 GENERAL

A. Water service connections shall be installed to the properties adjacent to the water transmission mains both to the same side of the roadway (Short Side Service) and to the opposite side of the roadway (Long Side Service) as directed by the County.

B. Water service connections installed under roadway (long side service) shall be pulled through a 2" PVC casing. Casings shall be installed through a bored hole approximately equal in diameter to the external diameter of the casing. Minimum cover under roadway shall be four feet. At other locations, minimum cover shall be two feet.

C. Installation shall conform to the details for water service connections appearing schematically on the Standard Detail Drawings. Contractor shall provide any and all appurtenant work required to provide the intended water service connections.

D. Extreme care shall be taken to provide adequate compaction and support under the service tubing adjacent to the main in order to prevent deflection of the tubing at the point of connection to the corporation stop.

E. No new meter boxes shall be located within a sidewalk or pavement.

3.02 CONNECTIONS TO WATER MAINS FOR WATER SERVICE

A. Connections to ductile iron pipe water mains shall be by the direct tap method or service clamp in full accordance with AWWA requirements.

B. Connections to polyvinyl chloride pipe water mains shall be made using a full body service clamp.

C. Pressure ratings shall be as required for the installation.

D. Tapping Saddle clamp shall be Ford Model S90 for 2" pipe size, Ford Model 202BS for 4" and larger pipe sizes or a BCWSA approved equal.

3.03 RELOCATION OF WATER SERVICES

A. Relocate the existing meter to the new right-of-way limits and reconnect to the house service. Existing meters already located at the new right-of-way limits will not need relocating.

B. Before disconnecting the existing meter, the existing corporation in the main shall be closed. All existing meters and meter boxes shall be removed, if not already located at the right-of-way, reinstalled and reconnected.

C. Existing service lines shall be field-located by the Contractor. The Contractor shall be responsible for locating existing water meters, relocating the meters and meter boxes as necessary, and determining the existing size service line to reconnect the meters to the new water mains. All service lines installed under existing pavement, including streets, driveways and sidewalks, shall be installed by boring.

D. The Contractor shall be prepared to make emergency repairs to the water system, if necessary, due to damage by others working in the area. In conjunction with this requirement, the Contractor shall furnish and have available at all times, a tapping machine, for the purpose of making temporary water service taps or emergency repairs to damaged water services.

3.04 TRANSFER OF WATER SERVICE

Transfer of Service: Immediately before connecting to the relocated or existing meter, all service lines shall be flushed to remove any foreign matter. Any 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.

END OF SECTION

END OF ARTICLE 3

ARTICLE 4

STANDARD SPECIFICATIONS FOR WASTEWATER SYSTEM CONSTRUCTION

SECTION 4.1 - SEWERS AND ACCESSORIES

PART 1 GENERAL

1.01 SCOPE

A. This Section describes products to be incorporated into sewers and accessories and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.

B. Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.

1.02 QUALIFICATIONS

If requested by the County, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

1.03 SUBMITTALS

If required, submit shop drawings, product data and engineering data for BCWSS approval.

1.04 TRANSPORTATION AND HANDLING

A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.

B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front loader. Do not use material damaged in handling. Lined pipe shall be handled to prevent damage to lined surfaces.

1.05 STORAGE AND PROTECTION

A. Store all pipe which cannot be distributed along the route. 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 shall be drained and stored in a manner that will 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; bell, plain end. At least two 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 pipe in adjacent tiers.

D. Store joint gaskets 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.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE (DIP) AND FITTINGS

A. Ductile iron pipe used for gravity sewer and force mains shall be installed as required by Barrow County Standards or as otherwise directed by BCWSS. All ductile iron pipe, except for specials, shall be furnished in nominal lengths of 18 to 20 feet.

B. Ductile iron pipe shall conform to AWWA C150 and AWWA C151. Unless otherwise required by the County, ductile iron pipe shall have a minimum pressure rating and corresponding wall thickness as indicated in the following table:

Pipe Size (inches)	Pressure Class (psi)
4 - 12	350
14 - 20	300
24 and greater	250

C. Fittings

1. Fittings for all gravity sewer and force mains shall be ductile iron pipe.

2. Minimum working pressure shall be 350 psi for sizes 4 - 24 inches nominal diameter and 250 psi for all sizes larger than 24-inch nominal diameter.

3. Compact fittings shall be in accordance with AWWA C153.

D. Ductile iron pipe and fittings shall be lined with Protecto 401 ceramic epoxy in accordance with the manufacturer's recommendations and furnished with a bituminous outside coating. Applies to all gravity and force main piping.

E. Joints

1. Ductile iron pipe and fittings shall be push-on or restrained joint type conforming to AWWA C111 or flanged joint type conforming to AWWA C115.

2. Restrained Joints

a. American Cast Iron Pipe Company (ACIPCO) FAST-GRIP and U.S. Pipe FIELD-LOK gasketed joints or approved equal are acceptable for restraint of push-on pipe and fittings 12 inches and less nominal diameter.

b. ACIPCO FLEX-RING or LOK-RING, U.S. Pipe TR-FLEX or approved equal are acceptable for all sizes of ductile iron pipe and fittings.

c. Mechanical joints using a retainer gland are acceptable for all sizes of ductile iron pipe and fittings. Retainer glands shall be Mega-Lug Series 1100 as manufactured by EBAA Iron, Inc. or approved equal.

3. No field welding of restrained joint pipe will be permitted.

4. Restrained joint pipe on supports shall have bolted joints and shall be specifically designed for clear spans of 36 feet, minimum. Joints for restrained joint pipe on supports shall be American LOK-FAST or approved equal.

5. Provide the appropriate gaskets for joints. Gaskets for flange joints shall be made of 1/8-inch thick, cloth reinforced rubber; gaskets may be ring type or full face type.

6. Bolts and Nuts

a. 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.

b. Bolts and nuts for mechanical joints shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.

c. 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.

d. 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.

e. 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.

F. 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. Weld-on collars shall be continuously welded to the pipe by the pipe manufacturer.

G. Solid Sleeves: Solid sleeves shall permit the connection of plain end ductile iron pipe and plain end PVC 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 a mechanical or restrained joint as specified in this Section and as shown on the Drawings. Solid sleeves shall be provided with gaskets suitable for the type of pipe to be connected. Solid sleeves shall be used only in locations shown on the Drawings or at the direction of the Engineer. Solid sleeves shall be manufactured by ACIPCO, U.S. Pipe or McWane (Clow).

H. Ductile iron pipe shall be encased with polyethylene film where shown on the Drawings. Polyethylene film shall meet the requirements of AWWA C 105.

I. Provide detection tape over all ductile iron pipe force mains.

J. Acceptance will be on the basis of 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 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Gravity Sewers

1. PVC gravity sewer pipe 8 - 15 inches nominal diameter shall be SDR 26 conforming to ASTM D 3034.

2. PVC gravity sewer pipe 18 - 24 inches nominal diameter shall be SDR 26 conforming to ASTM F 679.

3. PVC gravity sewer pipe shall be green in color and supplied in lengths not less than 13 feet and not greater than 20 feet.

4. Joints for PVC gravity sewer pipe 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 the approval of the County and shall be identical for pipe and fittings.

5. PVC gravity sewer lines shall be connected to manholes utilizing a standard pipe section.

6. Acceptance will be on the basis of the County's inspection and the manufacturer's written certification that the pipe and fittings were manufactured and tested in accordance with the applicable standards.

B. Force Mains

1. PVC force main pipe shall be Pressure Class 235 (DR 18) conforming to AWWA C 900.

2. PVC force main pipe shall be green in color with outside diameter meeting dimensions of ductile iron pipe.

3. PVC force main pipe shall be supplied in 20 foot nominal lengths.

4. Fittings

   a. Fittings for PVC force mains shall be ductile iron meeting applicable County specifications.

   b. Special adapters or gaskets shall be provided as recommended by the Manufacturer.

   c. Manufacturer to adapt the PVC pipe to mechanical joints with cast or ductile iron pipe, fittings or valves.

5. Joints for PVC force mains shall have integral bell and spigot type joints with elastomeric gaskets having the capability of absorbing expansion and contraction without leakage. Joints shall meet the requirements of ASTM D 3139; gaskets shall meet the requirements of ASTM F 477. Joint system shall be subject to the approval of the County and shall be identical for pipe and fittings.

6. Provide detection tape over all PVC force mains.

7. Acceptance will be on the basis of the County's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

2.03 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: Sanitary Sewerage Systems, Safety Green, "Caution: Sewer Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2 inches when buried less than 10 inches below the surface. Tape width shall be minimum 3 inches when buried greater than 10 inches and less than 20 inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

2.04 HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

A. HDPE pipe and fittings shall be made with minimum materials designation code of PE 4710 in accordance with AWWA C906 and minimum cell classification of PE554574C in accordance with ASTM D3350.

B. The HDPE pipe manufacturer shall provide certification that stress regression testing has been performed on the specific polyethylene resin being utilized in the manufacture of this product. This 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 (HDB) of 1,600 psi as determined in accordance with ASTM D2837.

C. Pipe shall have an outside diameter equal to ductile iron pipe for the same nominal size (DIPS). As a minimum strength, pipe shall have a dimension ratio of 11 (DR 11) and a working pressure rating of 200 psi.

D. Fittings shall be butt fusion fittings and shall comply with ASTM D3261. Molded and fabricated fittings shall have material designation and pressure rating equal to the pipe.

E. HDPE pipe and fittings shall be manufactured by a single manufacturer. The pipe manufacturer shall have an ISO 9000 quality management certification for HDPE pipe and fittings.

F. Pipe and fitting marking: Color identification shall be permanently marked, either solid green color or co-extruded green stripes on the pipe outside surface applied as part of the manufacturing process. Pipe and fittings shall be clearly marked as required by AWWA C906, including the following:

1. Nominal size and outside diameter base (e.g., DIPS).

2. Dimension ratio or custom wall thickness (e.g., DR 11).

3. Manufacturer's name or trademark.

4. Standard materials designation code (e.g., PE 4710) and 9-character cell class designation (e.g., PE554574C).

5. Manufacturer's production code including date of manufacture.

2.05 RIVER PIPE

Pipe used for uncased force mains crossing streams shall be ACIPCO FLEX-LOK ductile iron pipe ball and joint type or approved equal.

2.06 MANHOLES AND PRECAST CONCRETE PRODUCTS

A. Precast Concrete Sections

1. Precast manhole concrete sections shall be manufactured, tested, and marked in accordance with latest provisions of ASTM C 478.

2. Precast concrete sections for utility vaults and other water system structures shall be manufactured, tested and marked in accordance with ASTM C 858 and ASTM C 91.

3. Precast concrete manholes shall consist of precast reinforced concrete sections, a conical or flat slab top section, and a base section conforming with the Standard Details.

4. Ends of each reinforced concrete manhole riser section and bottom end of manhole top section shall be so formed that when manhole risers and top are assembled, they will make a continuous and uniform manhole.

5. Transition slabs which convert bases larger than four feet in diameter to four foot diameter risers shall be designed by the manhole manufacturer to carry the live and dead loads exerted on the slab.

6. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1 inch. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS202.

7. Each section of the precast manhole shall have not more than two holes for the purpose of handling and laying. These holes shall be tapered and shall be plugged with rubber stoppers or grout after installation.

8. Holes in manhole bases to receive sewer pipes shall be precast at the factory at required locations and heights. Knocking out of holes in the field will not be permitted.

9. Manhole inverts shall be constructed of ASTM C 150 Type I concrete in accordance with details on Drawings and shall have the same cross section as the invert of the sewer with which they connect. Invert shall be carefully formed to required size and grade by gradual and even changes in sections. Changes in direction of flow through sewer shall be made to a curve with as large a radius as size of manhole will permit.

10. Precast inverts will not be allowed.

B. Iron Castings

1. Cast iron manhole frames, covers and steps shall meet the requirements of ASTM A 48 for Class 35B gray iron castings and all applicable local standards. All castings shall be tough, close grained, smooth and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections. No casting will be accepted which weighs less than 95 percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking.

2. Manhole frames and covers shall be as shown on the Standard Details.

3. Except where structure top is installed at grade, frames shall be cast into the manhole cone or structure top.

4. All frames and covers shall have machined horizontal bearing surfaces.

5. All manholes shall have standard frames and covers except where specifically required by the County.

6. Watertight covers shall be bolt-down type and shall be equipped with four 1/2-inch stainless steel bolts and a 1/8-inch red rubber or rubber O-ring gasket. Covers shall be rotatable and interchangeable. Bolt holes shall be bored through so that debris entering the bolt hole will fall into the manhole. Bolt holes shall have the full 360-degree circle within the cover's radius when bored through the cover.

7. The words “BARROW COUNTY SEWER” shall be cast in all manhole covers in raised letters minimum 2 inches in height.

C. Plastic Steps: Manhole steps of polypropylene molded around a steel rod equal to products of M.A. Industries shall be used as determined by BCWSS. Manhole steps shall meet the requirements of ASTM C 478 for design, materials of construction, dimensions, testing and acceptance.

D. Rubber Boots: Provide preformed rubber boots and fasteners equal to those manufactured by Kor-N-Seal or Press Seal Gasket Corporation.

E. Brick used in manhole construction shall be either solid or cored, medium hard or better, Grade SM brick conforming to requirements of ASTM C 32 for sewer and manhole brick.

F. Mortar for brick manhole construction shall be sand-cement mortar composed of one part portland cement to two parts clean sand conforming to ASTM C 144. Twenty pounds of hydrated lime per sack of cement may be added. No retempered mortar shall be used.

G. Manhole and Precast Concrete Coating

The following systems are approved for protection of wetwell and, where required, manhole interiors in corrosive environments:

Manufacturer	Surfacer for Repair/Rehabilitation (as needed)	Intermediate Coat	Top Coat
TNEMEC	Series 217 or Series 218 Filler	Perma-Shield Series 434	Perma-Shield Series 435
Sauereisen	Underlayment Series F-120, Series F-121 or Series F-209 Filler	Sewergard Series 210, 210FS, 210S, 210RS or 210X	Sewergard Series 210G
Induron	EFS 707 Epoxy Surfacer or MortarChem	E-Bond 100	Ceramasafe 90

All coatings shall be installed in accordance with the manufacturer's recommendations.

H. Floor Door

1. Door shall be a single or double leaf type as required by the County and built to withstand 150 pounds per square foot.

2. The frame shall be 1/4-inch extruded aluminum with built-in neoprene cushion and with strap anchors bolted to the exterior. Door leaf shall be 1/4-inch aluminum diamond plate reinforced with aluminum stiffeners as required. Stainless steel hinges shall be bolted to the underside and pivot on torsion bars that counterbalance the door for easy operation. The door shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release the cover for closing. Doors shall be equipped with a snap lock and removable handle. Door shall also be equipped with hasp and padlock in addition to built-in locking mechanisms. Padlocks for all doors shall be keyed alike. Bituminous coating shall be applied to the exterior of the frame by the manufacturer. All parts shall be aluminum or stainless steel.

3. The floor door shall be Type K, equal to The Bilco Company, Halliday Products or Thompson Fabricating Company “TuffHatch”.

I. Air Valve Manholes

1. Manholes for air valves shall have a minimum diameter of 6 feet. A minimum clearance of 6 inches shall be maintained between the top of the air valve and the bottom of the manhole top.

2. Manhole lids shall be vented.

2.07 PLUG VALVES

A. Valves shall be 90 degree turn, non-lubricated, eccentric type with resilient faced plugs. Design of the valve shall provide that contact between the seat and the plug shall only occur in the final degrees of plug movement. Valves shall be suitable for throttling and service where valve operation is infrequent.

B. Operating Requirements: Valves shall provide drip-tight shut-off up to the full pressure rating with pressure in either direction. Pressure ratings shall be established by hydrostatic tests conducted in accordance with ANSI B16.1. Valves shall be rated at a minimum of 150 psi. Valves shall have a port area equal to at least 67 percent of the full pipe area.

C. For plug valves larger than 2 inches in diameter, bodies shall be cast-iron conforming to ASTM A 126, Class B. Plug valves 2 inches or smaller shall be carbon steel. All exposed nuts, bolts, springs, washers, etc. shall be zinc coated in accordance with ASTM A 153.

D. Valves shall have flanged or mechanical joint ends as required for either buried or non-buried service. Flanged valves shall have ANSI 125 pound standard flanges. Mechanical joint valves shall have bell ends conforming to applicable requirements of ANSI 21.11. Flanged valves with flange-to-MJ adapters shall not be acceptable in lieu of MJ valves.

E. Valve seats shall be a raised welded-in overlay of not less than 90 percent pure nickel, machined to mate with the resilient faced plug. Overlay shall be minimum of 1/8 inch thick.

F. Valve plugs shall be of semi-steel conforming to ASTM A 126 Class B. Plug facing shall be a synthetic rubber compound of approximately 70 durometer hardness bonded to the plug. Facing material shall be abrasion resistant and suitable for service in sewage and sludge applications.

G. Valves shall be furnished with replaceable sleeve-type bearings in the upper and lower journals. Bearings shall comply with applicable requirements of AWWA C507. Bearing materials shall have a proven record of service of not less than five years.

H. The valve body shall be fitted with a bolted bonnet incorporating a stuffing box and pull-down packing gland. Packing shall be the split chevron type. Design of exposed valves shall allow visible inspection of the shaft seal, adjustment of the packing, and replacement of the packing, all without disturbing the bonnet or valve operator. The shaft seal shall comply with the requirements of AWWA C504.

I. Valve Operators

1. Above Ground

a. Plug valves 6 inches in diameter and smaller shall have manual levers. Levers shall be steel with a non-metallic grip.

b. Plug valves 8 inches in diameter and larger shall have manual hand wheels operated with totally enclosed worm gear operators.

2. Buried service valves shall have totally enclosed worm gear actuators, 2-inch square AWWA operating nuts and valve boxes. Buried valve operators shall be extended to within 6 inches of grade. Valves and operators for buried service shall have seals on all shafts and gaskets on valve operator covers to prevent the entry of water. All exposed nuts, bolts, springs and washers for buried valves shall be stainless steel.

J. All plug valves shall be products of a single manufacturer who must submit evidence of five years satisfactory service in sewage applications of the same design and of the sizes required. Valves shall be manufactured by DeZurik or Keystone.

2.08 CHECK VALVES

A. Check valves shall be hinged disc type with cast iron body and bronze or bronze-fitted disc. Valves shall be designed for 150 psi and shall not slam shut on pump shutdown. Valves shall be equipped with a 1/2-inch stop cock at the high point of the valve for bleeding air from the line.

B. Valves shall be outside spring and lever type.

C. Valves shall be of the globe design with ANSI 125 pound flanges.

D. Valves shall be G.A. Industries or APCO.

2.09 AIR VALVES

A. Air Release Valves: Valves shall be automatic air release valves designed to allow escape of air under pressure and close water-tight when liquid enters the valve. Valve shall have a 1-inch NPT inlet and a maximum orifice diameter of 3/32-inch. The valve body shall be cast iron, designed to facilitate disassembly for cleaning

and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion-resistant materials. Valves shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without dismantling the valve.

B. Air/Vacuum Valves: Valves shall be automatic air and vacuum valves designed to allow escape of air, close water-tight when liquid enters the valve, and allow air to enter in the event of a vacuum. The valve body shall be cast iron, designed to facilitate disassembly for cleaning and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion-resistant materials. Valves shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without dismantling the valve. The valves shall have an orifice diameter of 2-inches and NPT inlet and outlet diameters of 2 x 2-inches.

C. Combination air valve shall consist of an air release valve tapped into the body of an air and vacuum valve.

D. Single Body Valve: In lieu of D above, a single body, double orifice, sewage combination valve may be used. Materials of construction, orifice size, venting capacity and accessories shall meet the requirements of B and C above.

E. Valves shall. be recommended by the manufacturer for wastewater service with normal operating pressures to approximately 60 psig, and frequent surge pressures of approximately 175 psig and shall be equal to APCO Valve Corporation or Val-Matic.

2.10 VALVE BOXES AND EXTENSION STEMS

A. All valves shall be equipped with valve boxes. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5.25 inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6 inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have “SEWER” cast into them. Valve boxes shall be manufactured in the United States.

B. All valves shall be furnished with extension stems, as necessary, to bring the operating nut to within 30 inches of the top of the valve box. Connection to the valve shall be with a wrench nut coupling and a set screw to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller 26441 or M&H Valve, Style 3801.

2.11 VALVE MARKERS

A. The Contractor shall provide a fiberglass valve marker for each valve installed. The marker shall be a fiber reinforced composite material with an ultraviolet light inhibitor and curved cross section with a minimum dimension of 3.75-inches wide. The post design shall be capable of flattening out when hit and then returning to its normal upright position. The marker shall be installed according to manufacturer's specifications. The decal shall be placed on the side of the marker which is facing the roadway.

B. Valve markers shall be Rhino FiberCurve™ Fiberglass Utility Marking Post with PolyTech Coating™ or a BCWSA approved equal. The valve markers shall be blue and 66-inches in length. Each valve marker shall have the TriView Marking System decal #GD8-5194K.

2.12 ANCHOR COUPLINGS

Anchor couplings shall be equal to Tyler Pipe 5-198.

2.13 FLANGE ADAPTER

The flange adapter shall permit the connection of unthreaded, ungrooved, open-ended ductile iron pipe to ANSI/ASME B16.1, Class 125 flanges. The flange adapter shall meet the test requirements of ANSI/ASME B16.1 for Class 125 flanges. The adapter shall be a ductile iron casting incorporating a flange with extended throat, set screws and gasket. The gasket shall provide a compression seal between the adapter, the pipe and the adjacent flange. Flange adapters shall be used only in locations specifically shown on the Drawings or at the direction of the County, and in accordance with the manufacturer's recommendations. The flange adapter shall be manufactured by McWane, EBAA Iron Sales, Inc. or Ford Meter Box Company, Inc. Additionally, flange adapters shall be provided with 304 stainless steel harness rods of the diameter and quantity shown on the Drawings or directed by the County.

2.14 FLEXIBLE ADAPTER COUPLINGS

A. Couplings for pipe sizes 15 inches in diameter and less 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 rootproof up to 4.3 psi. The adapter manufacturer shall provide all stainless steel clamps and required accessories.

B. Couplings shall be products of Fernco and shall be installed in accordance with the manufacturer's recommendations.

2.15 FLEXIBLE ADAPTER DONUTS

A. Adapter donuts shall be elastomeric polyvinyl chloride (PVC), compressible seals designed for sealing joints between sewer pipes of different sizes and/or dissimilar materials. Adapters shall provide a positive seal against infiltration and exfiltration and remain leakproof and rootproof up to 4.3 psi.

B. Donuts shall be products of Fernco and shall be installed in accordance with the manufacturer's recommendations.

2.16 PIPE SUPPORTS

Pipe supported from underneath and not subject to expansion shall have adjustable pipe saddle supports on properly sized pipe stanchions and ample, properly grouted floor flanges. Saddle supports shall b equal to Grinnell, Figure 264 or Fee and Mason, Figure 291.

2.17 UTILITY SHROUDS

Utility shrouds for clean-outs at connections of sewer service lines with sewer mains shall be Utility Defender Cleanout Defender CD-V118. Utility shrouds for cleanouts in unpaved areas shall be equipped with HDPE cap with 24" pivoting marker pole. Utility shroud for cleanouts in paved areas shall be equipped with cast iron traffic ring and cover.

PART 3 EXECUTION

3.01 EXISTING UTILITIES AND OBSTRUCTIONS

A. The Contractor shall call the Utilities Protection Center (UPC) (811) as required by Georgia law (Code Section 25-9-1 through 25-9-13) and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site, at least 72 hours (three business days) prior to construction, to verify the location of the existing utilities.

B. The Contractor shall be required, at his own expense, to do everything necessary to protect, support, and sustain all sewers, culverts, water, or gas pipes, electric lights, power, telephone, or telegraph poles or conduits, and other fixtures laid across or along side of the work, even to the extent of using hand labor in making trench openings under or over these. BCWSS, as well as company or corporation owning said pipes, poles, or conduits must be notified in advance of same by Contractor, before any such fixtures are removed or disturbed. In case any of said sewer, gas, or water pipes, service pipes, electric lights, power, telephone or telegraph poles or conduits, or other fixtures are damaged they shall be repaired by authorities having control of the same, and expense of said repairs shall be paid by Contractor.

C. No underground or overhead facilities encountered shall be disturbed without proper authorization from BCWSS, and then only in such manner as BCWSS may prescribe and approve.

D. Should it become necessary to change position, or permanently or temporarily remove any electric conduits, telephone conduits, water pipes, gas pipes, sewerage pipes, or other pipes, conduits, or wires in order to clear structure being built or to permit Contractor to use a particular method of construction, Contractor shall cease work if necessary, until satisfactory arrangements shall have been made by owners of said pipes, wires, or conduit, to properly care for

or relocate same as necessary to permit work to proceed as required for proper completion.

E. Water and Sewer Separation

1. Sewers should maintain a minimum 10 foot edge-to-edge separation from water mains. Where the sewer crosses below a water main, an 18 inch vertical separation shall be maintained where possible. Where possible, a full joint of sewer pipe shall be centered below the water main. Any deviation shall be requested in writing to the County.

2. Where the sewer crosses over a water main, either:

a. The water main shall be encased in concrete to the first joint in each direction, or

b. The sewer main shall be encased either in a watertight casing pipe or in concrete with a minimum 6-inch concrete depth to the first joint in each direction.

3. No water main shall be permitted to pass through or come in contact with any part of a manhole.

3.02 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS

A. Install pipe lines and appurtenances along highways, streets and roadways in accordance with the applicable regulations of, and permits issued by, the Department of Transportation, and Barrow County with reference to construction operations, safety, traffic control, road maintenance and repair.

B. Traffic Control

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 Georgia DOT approved flagman 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 the Department of Transportation, and Barrow County a minimum of 48 hours in advance of the activity.

4. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the current 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. 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, strip and stockpile all sod, topsoil and other material suitable for right-of-way restoration.

3. Trenching, Laying and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day; under no circumstances should any section of trench be left open, uncovered overnight, or unattended.

4. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod and any other materials removed from shoulders.

D. Excavated Materials: Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off the pavement in a timely manner.

E. Drainage Structures: 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.

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 re-establishing these features.

G. Maintaining Highways, Streets, Roadways and Driveways

1. 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, maintain highways, streets and roadways by the use of steel running plates. The edges of running plates 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. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways. Make the grader or front-end loader available at all times.

4. Immediately repair all driveways that are cut or damaged. 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 will not interfere with traffic.

B. No pipe shall be strung further along the route than 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 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.

C. No street or roadway may 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 feet from the roadway pavement, as measured edge-to-edge.

3.04 LAYING AND JOINTING PIPE AND ACCESSORIES

A. Lay all pipe and fittings to accurately conform to the lines and grades approved by the County.

B. Pipe Installation

1. Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe, fittings and valves 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 sewer materials and protective coatings and linings. Under no circumstances shall sewer materials be dropped or dumped into the trench.

2. All pipe, fittings, valves and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the County, who may prescribe corrective repairs or reject the materials.

3. 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 which contains dirt shall be laid.

4. 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.

5. 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.

6. It is common practice to lay pipe with the bells facing the direction in which work is progressing, however, it is not mandatory.

7. 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.

8. Precautions should be taken to prevent flotation of the pipe in the trench.

9. Detection tape shall be buried 4 to 10 inches deep. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20 inches from the finish grade surface.

10. Polyethylene Encasement: Installation shall be in accordance with 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 Engineer.

11. Directional Bore Installation

    a. Horizontal Directional Drilling (HDD) is permitted for installation of HDPE force main where shown on the Drawings. HDD must be performed by a qualified Contractor. Contractor references describing prior experience with similar type projects shall be submitted to the Engineer for approval. All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety.

b. Contractor will submit specifications on directional drilling equipment to be used to ensure that the equipment will be adequate to complete the project. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing & delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

i. Drilling Rig: The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations.

ii. Drill Head: The drill head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.

iii. Mud Motors (if required): Mud motors shall be of adequate power to turn the required drilling tools.

iv. Drill Pipe: Shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC.

v. Guidance System: The Guidance System shall be of a proven type and shall be setup and operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.

C. Alignment and Gradient

1. Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.

2. Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

3. The Contractor shall check the invert elevation at each manhole and the pipe invert elevation at least three times daily, start, mid-day and end of day. Elevations shall be checked more frequently if more than 100 feet of pipe is installed in a day or if the pipe is being constructed at minimum slope.

4. The Contractor shall check the horizontal alignment of the sewer at the same schedule as for invert elevations.

5. Install force mains to avoid generating high points except where shown on the Drawings.

D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, 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. Each restrained joint shall be inspected by the Contractor to ensure that it has been “homed” 100 percent.

3. The Contractor shall internally inspect each pipe joint to insure proper assembly for pipe 24 inches in diameter and larger after the pipe has been brought to final alignment.

4. HDPE Pipe

a. The pipe shall be joined by the butt fusion procedure outlined in ASTM F2620 and AWWA M55. Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. All fusion joints shall be performed in strict accordance

with the pipe manufacturer's recommendations. The butt fusion joining shall produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. Field mitered (angled) butt fusion joining shall not be permitted.

b. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including but not limited to, temperature requirements and interfacial fusion pressure.

c. All pipe and fittings joined shall be made from the same materials, cell classification, size, dimension ratio, and pressure class.

d. All pipes shall be joined using a data logger to record temperature and fusion pressure, which will produce a graphic representation of the fusion cycle that shall be part of the Quality Control records that will be provided to OCWRD with the as-built drawings and upon request during construction.

e. All transitions from HDPE pipe to ductile iron pipe, valves, and ductile iron fittings shall be made with a mechanical joint adapter per AWWA C906 and the HDPE pipe manufacturer's recommendations and specifications.

i. Transitions shall be from the same manufacturer of the HDPE pipe and/or fittings, and HDPE shall be made of the same materials, cell classifications, size, dimension ratio, and pressure class.

ii. Mechanical joint adapter shall be provided from the manufacturer with a stainless steel pipe stiffener for the HDPE pipe on the mechanical joint side.

iii. Due to high thermal elasticity of HDPE pipe, the installed pipe shall be allowed to rest bedded in the trench a minimum of 12 hours before tie-in.

iv. Bell holes shall be provided in bedding at mechanical joints to minimize shear loads on pipe.

F. Cutting of Pipe

1. Cut ductile iron pipe using an abrasive wheel saw.

2. Cut PVC and HDPE pipe using a suitable saw.

3. Remove all burrs and smooth the end before jointing.

4. 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. 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 corrected or held for inspection by the County. 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 12-inch and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve.

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 will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 30 inches beneath finished grade so as to set the top of the operating nut 30 inches below finished grade. 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 required by the County, valve markers shall be installed 6 inches inside the right-of-way or easement.

H. House Connections: Install wyes or tees in locations designated by the County for future connection of service lines. Plug the branch of the wye or tee. Record the location of fittings installed on a copy of the Contract Drawings to be submitted as Record Drawings.

I. Tracing Wire: Tracing Wire shall be installed in the same ditch as PVC and HDPE force main pipe and shall be marked by the use of a continuous multi-strand wire, 10 gauge THHN, green in color for force mains, and purple in color for reuse mains, for the entire length of the pipe. The wire shall be affixed to the top of the pipe by identification tape. In situations where identification tape will not adhere to the pipe, the marking wire shall be wrapped around the pipe. Where splices are required, they shall be in accordance with County Standards. All mains shall have locator boxes installed a minimum of every 1,000 feet.

3.05 MANHOLE AND PRECAST CONCRETE PRODUCT CONSTRUCTION

A. Construct manholes and vaults as shown in the Drawings in accordance with the Standard Details.

B. Precast Concrete: Handle sections carefully to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent uneven loading. Install gaskets and joint sealants in accordance with manufacturer's recommendations to produce a watertight structure.

C. Pipe Tee: Place, joint, and properly backfill the pipe tee prior to placing any riser sections. Meet all requirements for precast manholes.

D. Brick: Bed the bottom and sides of every brick in mortar. Apply a smooth coat of mortar, 3/4-inch thick, on the inside and outside.

E. Pipe Connections

1. All pipes shall be connected to precast concrete manholes by a rubber boot provided in a cored or precast hole of the proper diameter.

2. For HDPE Pipe, install the manhole entry pieces as follows:

a. Do not cut the smoothwall manhole entry piece. Instead, cut the spigot end off of standard quarter, half or full length pipe so that the manhole entry piece is properly positioned in the manhole wall.

b. Prepare the field cut end so that a standard sealing ring can be installed for a watertight joint in accordance with manufacturer's recommendations.

c. Connect rubber boot to the manhole entry piece and to the manhole wall using fasteners recommended by the boot manufacturer.

F. Inverts: Form channels as shown on the Standard Details, rounded, and troweled smooth. Maintain consistent grade through the invert.

G. Top Elevations: Build manholes outside of paved areas to 36 inches above finished grade unless otherwise required by the County. Build manholes in paved areas to existing grades, unless otherwise pre-approved by OCWRD.

H. Drop Connections: Manholes requiring drop connections are determined by the County. Construct drop connections of the same materials as the upstream sewer and in accordance with the details shown on the Standard Details. Outside drop connections shall be constructed when the invert of the inflowing pipe is 24 inches or greater above the manhole invert.

I. Frames and Covers: Unless frame and cover is at grade, the frame shall be cast into the cone section.

J. Floor doors shall be integrally cast into the top slab, and shall be cast into the concrete in accordance with the manufacturer's recommendations.

K. Seal all manhole joints and lift holes, both inside and out, with grout. Between precast sections, this is in addition to joint sealant.

L. Manholes shall be constructed such that their walls are plumb.

M. Air Valve Manholes

1. Construct the manhole as approved by the County.

2. Install vent pipes or insure that the frame and cover or floor door shall be provided with 1-inch holes to provide equivalent opening as an air valve, but not less than two. The quantity for each valve size is as follows: 2-inch, 4; 3-inch, 9; 4-inch, 16; 6-inch, 36; 8-inch, 64.

3.06 THRUST RESTRAINT

A. Provide restraint at all points where hydraulic thrust may develop.

B. Retainer Glands: Provide retainer glands where required by the County and all associated fittings, valves and related piping. 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 which do not have inherent torque indicators.

C. Harnessing: Provide harness rods only where required by the County. Harness rods shall be manufactured in accordance with ASTM A 36 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. Where possible, harness rods shall be installed through the mechanical joint bolt holes. Where it is not possible, provide 90 degree bend eye bolts. 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. Concrete Blocking

1. Provide concrete blocking for all other bends, tees, valves, and other points where thrust may develop, except where other means of thrust restraint are required by the County.

2. Form and pour concrete blocking at fittings as required by the County. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation.

3. Refer to the Standard Details for minimum dimensions for concrete blocking.

E. Thrust Collars: Collars shall be installed on force mains and gravity sewers where required and constructed in accordance with the Standard Details. The welded-on collar shall be attached to the pipe by the pipe manufacturer.

3.07 INSPECTION AND TESTING

A. Clean and test lines before requesting final acceptance. Where any obstruction is met, clean the sewers by means of rods, swabs, or other instruments. When requested by the County, flush out lines and manholes before final inspection.

B. Coordination of Inspection: The Contractor is responsible to coordinate with the County to inspect the construction of the sewer lines and appurtenances. Pre-notification by the Contractor is required to allow scheduling of inspection.

C. Gravity Sewers

1. Pipe lines shall be straight and show a uniform grade between manholes. Correct any discrepancies discovered during inspection.

2. Mandrel Test

a. Mandrel shall be pulled through all gravity sewer pipe while County inspector is present.

b. Mandrel test shall be performed on each section of pipe to monitor deflection and to ensure that the requirements of the specification are being met. The following steps shall be followed when performing the mandrel test:

i. Verify line is clean and free of debris that might cause the device to jam. It is recommended that the line be cleaned with a hydro-cleaner washing in the direction of flow.

ii. Pull a line through the pipe with which to pull the mandrel. This can be done in several ways:

1) If a hydro cleaner is being used, attach the pull line to the nozzle end before the actual cleaning cycle starts. As the hose is pulled through the line, it will carry the pull line with it. When the hose nozzle reaches the manhole, disconnect the pull line and tie it off.

2) A parachute device can be blown through the line with a lightweight string attached. Detach the string, and attach the pull line. Manually drag the pull line through the pipe. Tie off each manhole.

iii. Pull mandrel by hand through pipe. The pulling motion should be smooth and easy to avoid jamming the mandrel if an obstruction is encountered in the line. The mandrel shall have a line on each end to facilitate removal should the mandrel become obstructed in the direction of pull. Do not use mechanical equipment to force the mandrel through the pipe.

c. Mandrel shall be sized to allow 7 ½ % maximum deflection in pipe dimension in accordance with ASTM D 3034. Mandrel shall have at least six (6) points. Mandrel test shall be made at least 48 hours after backfilling over pipe.

3. Low Pressure Air Test

a. During the progress of the work and prior to making any house connection, the Contractor shall test all gravity sewers for leakage in presence of County inspector by low pressure air in accordance with UNI-Bell Specification UNI-B-6.

b. Contractor may wish to conduct an air test for his own purposes prior to backfilling, however, air tests shall be accepted only after backfilling and compaction of sewer lines have been completed.

c. When allowed by County inspector, installed wyes, tees, and service laterals shall be plugged with either mechanical or pneumatic joint caps, or acceptable alternate, securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension. Plugs shall be internally restrained or externally braced to the manhole wall as an added safety precaution.

d. Prior to air testing, the section of sewer between manholes shall be thoroughly cleaned and wetted.

e. Immediately after cleaning or while the pipe is water soaked, the sewer shall be tested with low-pressure air. At the Contractor's option, sewers may be tested in lengths between manholes or in short sections (25 feet or less) using inflatable balls pulled through the line from manhole to manhole.

f. Air shall be slowly supplied to the plugged sewer section until internal air pressure reaches approximately 4.0 psi. After this pressure is reached and the pressure allowed to stabilize (approximately two to five minutes), the pressure may be reduced to 3.5 psi before starting the test. If a 1.0 psi drop does not occur within the test time, then the line has passed the test. If the pressure drops more than 1.0 psi during the test time, the line is presumed to have failed the test, and the Contractor will be required to locate the failure, make necessary repairs, and retest the line. Minimum test time for various pipe sizes, in accordance with UNI-B-6 is as follows:

Nominal Pipe Size (inches)	T, Min:Sec or (Sec/100 Feet)
6	5:40 (0.854 x L)
8	7:34 (1.520 x L)
10	9:26 (2.374 x L)
12	11:20 (3.418 x L)
15	14:10 (5.342 x L)
18	17:00 (7.692 x L)

g. Required test equipment, including inflatable balls, braces, air hose, air source, timer, rotameter as applicable, cut-off valves, pressure reducing valve, 0-15 psi pressure gauge, 0-5 psi pressure gauge with gradations in 0.1 psi and accuracy of $\pm$ two percent, shall be provided by the Contractor. Testing equipment shall be equal to Cherne Air-Loc Testing Systems.

h. The Contractor shall keep records of all tests made. Copy of such records will be given to the County. Such records shall show date, line number and stations, operator, and such other pertinent information as required by the County.

i. The Contractor is cautioned to observe proper safety precautions in performance of the air testing. It is imperative that plugs be properly secured and that care be exercised in their removal. Every precaution shall be taken to avoid the possibility of over-pressurizing the sewer line.

4. Video Inspection

a. Contractor shall provide, at his expense, a video of each segment of gravity sewer to be conducted by a person qualified in use of wastewater video equipment and technology.

b. The County inspector shall be notified a minimum of 24 hours in advance of the scheduled procedure.

c. Prior to video inspection all lines must jetted and cleared of all debris and tested by filling with water and dye to assure that all pipes are clear of dips. Inverts must be installed in manholes.

d. The video shall record the footage as the camera progresses through the sewer pipe. The location of each lateral shall clearly be shown on the video by both lot number and linear footage from the manhole.

e. The operator of the camera shall stop at each service connection and rotate the camera to view the inside of each service connection for noticeable defects, debris, and cleanliness.

f. Deflection of the pipe shall not exceed the following:

Nominal Pipe Size (inches)	Maximum Allowable Deflection (%)
≤ 12	5
15 - 30	4
> 30	3

g. The tape of the line inspection and field report in accordance with Article 1 of these Standards shall be provided to BCWSS.

h. Excavate and re-install properly any section of pipe not passing the inspection. Re-inspect until results are satisfactory.

D. Force Mains

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. Each segment of pipeline between line valves shall be tested individually.

2. Test Preparation

a. Flush pipeline section thoroughly at flow velocities adequate to remove debris from pipe and valve seats. 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.

3. Test Pressure: Test the pipeline at the greater, the highest pressure in the system or 150 psi, measured at the lowest point for at least two hours. 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.

4. 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. Leakage shall be the total cumulative amount measured on a water meter. BCWSS assumes no responsibility for leakage occurring through existing valves.

5. 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.

6. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.

E. Manholes

1. Prior to testing manholes for water-tightness, all lift holes 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.

2. After proper preparation as noted above, the manhole shall be vacuum tested. 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 effect 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 that specified in the table below. If the manhole fails the initial test, necessary repairs shall be made with non-shrink grout while the vacuum is still being drawn. Re-testing shall proceed until a satisfactory test is obtained. Vacuum testing equipment shall be equal to that as manufactured by P.A. Glazier, Inc.

Minimum Test Times (sec) for 4-ft and 5-ft Diameter Manholes		
Depth (feet)	**Diameter (feet)**	
	4	5
6	15	20
8	20	26
10	25	33
12	30	39
14	35	46
16	40	52
18	45	59
20	50	65

3. Vacuum testing after backfilling of the manhole may be allowed on a case-by-case basis depending on manhole depth and groundwater elevation if authorized by BCWSS.

3.08 PROTECTION AND RESTORATION OF WORK AREA

A. General: 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 started.

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. Prepare photographic documentation of sensitive areas along the project route/site to document conditions existing prior to project construction.

3. 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.

4. 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.

5. The Georgia Department of Transportation's engineer 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: 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: Do not disturb cultivated trees or shrubbery unless approved by the County. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.

D. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 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 work area and disposed of by the Contractor. No stumps, wood piles, or trash piles will be permitted on the work site.

E. Disposal of Rubbish: Dispose of all materials cleared and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate county, state and federal regulatory agencies.

F. Swamps and Other Wetlands

1. The Contractor shall not construct permanent roadbeds, berms, drainage structures or any other structures which alter the original topographic features within the easement.

2. All temporary construction or alterations to the original topography will incorporate measures to prevent erosion into the surrounding swamp or 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 which 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.

G. Bypassing or spilling wastewater onto the ground, into the trench, or into adjacent waters is prohibited.

H. Dust Control: The Contractor shall use all means necessary to control dust on and near the work, and on and near all off-site borrow areas when dust is caused by the operations during performance of the work or if resulting from the condition in which the subcontractor leaves the site. The Contractor shall thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of work on the site.

END OF SECTION

SECTION 4.2 - SEWER SERVICE CONNECTIONS

PART 1 GENERAL

1.01 SCOPE

The work covered by this Section shall consist of furnishing and installing service connections in the sewers.

PART 2 PRODUCTS

2.01 MATERIALS

A. Service connections shall be made at the top or from the side at 45 degrees of the sewer line using 6-inch diameter pipe as shown on the Standard Details. Service pipe shall be of the same material and quality as the main sewer line.

B. Riser connections shall be required when the main sewer line is 10 feet or more below finished grade, unless otherwise directed by the County.

C. The service connection shall extend from the sewer line to the edge of the permanent easement or right-of-way and be plugged.

D. If the service connection ends in rock, the Contractor shall excavate the rock an additional 10 feet beyond the plugged end.

E. Connection of service lines or risers to sewer line shall be by means of standard tees, as indicated on the Standard Details. Drawings shall reflect details of service connection from main to right of way.

PART 3 EXECUTION

3.01 INSTALLATION

Laying of service connection lines shall be in accordance with requirements of the Specifications for Sewers and Accessories.

END OF SECTION

SECTION 4.3 - SUBMERSIBLE PUMPS

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 and operable installation of all submersible pumps, motors and controls. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications and the manufacturer's recommendations.

B. Associated wet well, piping, valves, valve vault and other appurtenances shall be as specified elsewhere in the Standard Specifications and Details.

1.02 QUALIFICATIONS

The pump manufacturer shall have similar units in operation for a minimum of five years in the United States and demonstrate the ability to adequately respond to operational and maintenance needs including the replacement of worn or broken parts.

1.03 DESIGN REQUIREMENTS

A. Pumps shall be totally submersible, electric motor driven, non-clog, sewage pumps

B. The pump manufacturer shall review design and layout drawings to insure that installation arrangements are suitable for their equipment. Any potential conflicts or recommended modification shall be noted on the shop drawings or by a pre-submittal request for information if appropriate. Any modifications required to satisfy manufacturer's recommendations shall be at the Contractor's expense.

C. Operating requirements for pumps shall be as shown in Table 4.3.1.

D. The operating range of the pump shall include minimum head, rated and shut-off conditions. The pumps shall be non-overloading throughout this operating range.

E. Pumps with cooling jackets shall allow for continuous, unsubmerged operation without supplementary cooling. Pumps without cooling jackets shall allow continuous operation with a minimum submergence of one-half the stator housing height. Pumps shall be capable of running continuously at design capacity and head for a period of at least two hours with a water level at the top of the pump volute without overheating or damage to seals or watertight integrity.

F. Pump design shall incorporate an automatic discharge connection, allowing each unit to be removed for inspection or service by simply lifting the pump. Re-connection shall require only lowering of the pump into position.

1.04 FACTORY TESTING

The pump manufacturer shall conduct full scale, full range factory performance tests with respect to capacity, head and horsepower on each of the pump units to be provided on this Project. Certified test reports shall be submitted for approval, prior to shipment of the pumps. Tests shall be conducted in accordance with applicable Hydraulic Institute standards for acceptance Level "A"

1.05 SUBMITTALS

A. Submit shop drawings for all equipment furnished. Specific submittal information shall include:

1. Pump manufacturer's name, pump size or model number, weight and a descriptive bulletin of the pump to be furnished.

2. Outline dimension drawings of the pump.

3. Pump characteristic curves showing head capacity and horsepower, including minimum head, rated and shutoff conditions.

4. Motor manufacturer's name, motor horsepower, RPM and frame size, weight and descriptive bulletin of the motor to be furnished. Include motor manufacturer's certified dimension sheet that lists motor features and include typical motor data sheet.

5. Control panel schematics, panel dimensions and layout, and product data sheets.

B. Operation and maintenance manuals shall be furnished for the equipment.

1.06 STORAGE AND PROTECTION

A. Pumps and accessories shall be stored and protected in accordance with the manufacturer's recommendations.

B. Pumps shall be completely drained prior to shipment. Suction and discharge ports shall be provided with plastic plugs. Each pump shall be secured to a wooden skid to facilitate handling and storage.

1.07 QUALITY ASSURANCE

The manufacturer shall provide a written certification to the County that all equipment furnished complies with all applicable requirements of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

A. Pump Construction

1. All major parts, such as the stator casing, oil casing, volute, sliding bracket and discharge connection shall be of gray iron. All exposed bolts and nuts shall be stainless steel. All mating surfaces of major parts shall be machined and fitted with rubber O-ring seals where watertight sealing is required. All parts shall be interchangeable and watertight sealing shall not require additional machining of replacement parts, sealing compounds, or the application of specific torques to connectors.

2. No portion of the pump unit shall bear directly on the floor of the wet well. There shall be no more than one 90 degree bend allowed between the volute discharge flange and station piping.

3. A sliding guide bracket shall be an integral part of the pump unit. The volute casing shall have a machined discharge flange which automatically connects directly to, or through an intermediate coupling to a discharge base. The discharge base shall be bolted to the floor of the sump and shall have a flanged connection to the discharge piping. There shall be no need for adjustment, fasteners, clamps, or other devices to connect the pump to the discharge base.

B. Impeller

1. A wear ring system shall be installed to provide efficient sealing between the volute and impeller. The impeller shall be gray cast iron, BN 200 minimum, of non-clogging design, capable of handling solids, fibrous material, heavy sludge and other matter found in normal sewage applications.

2. The impeller shall be constructed with a long throughlet without acute turns. The impeller shall be dynamically balanced. Static and dynamic balancing operations shall not deform or weaken it. The impeller shall be a slip fit or taper fit to the shaft and key driven. Non-corroding fasteners shall be used.

C. Abrasion Resistance: All parts exposed to abrasive wear, case and impeller shall have a minimum of Brinell hardness of 200.

D. Each pump shall be provided with a mechanical, rotating shaft seal system running in an oil reservoir having separate, constantly hydro-dynamically lubricated, lapped seal faces. The lower seal unit between the pumps and oil chamber shall contain one stationary and one positively driven, rotating tungsten-carbide or silicon-carbide ring. The upper seal unit between the oil sump and motor housing shall contain one stationary tungsten-carbide to silicon-carbide ring and one positively driven rotating carbon ring.

E. Each interface shall be held in contact by its own independent spring system, supplemented by external liquid pressures. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. No seal damage shall result from operating the pumping unit out of its liquid environment. The seal system shall not rely upon the pumped media for lubrication. The oil reservoir shall have a drain and inspection plug, with positive seal, which shall be easily accessible from outside the pump.

F. A leakage sensing system shall be provided to detect the intrusion of moisture in either the seal chamber or stator housing.

2.02 GUIDE BARS

Guide bars shall be galvanized pipe or structural section attached to the automatic discharge connection at their lower end and to an upper guide bar bracket at their upper end. Intermediate guide bar supports shall be provided as required to insure a rigid installation. Guide bars shall not support any of the weight of the pump.

2.03 MOTOR

A. Pump Motor

1. Pump motors shall be designed in accordance with the standards of NEMA to operate at a standard 40 degree C ambient temperature.' The motor shall be designed for continuous duty capable of sustaining a minimum of 15 evenly spaced starts per hour. Refer to Table 1 for additional pump characteristics.

2. The motor shall be housed in a watertight casing. The pump shaft shall be a one-piece, solid shaft of AISI 400 Series stainless steel or C1034 carbon steel and shall be completely isolated from the pumped liquid.

3. The shaft shall be supported above and below the rotor by anti-friction bearings designed to provide long life and minimize shaft deflection. At least one bearing shall be double row type. Bearings shall have a minimum AFBMA B10 life of 40,000 hours.

4. The design may, if required, incorporate a positive, circulated cooling system to cool the motor. Passages for cooling media, where used, shall be adequately dimensioned to prevent clogging.

5. Thermal sensors shall be provided to monitor stator temperature. One thermal switch shall be imbedded in the end coils of each stator winding. The thermal switch shall be used in conjunction with, and in addition to, external motor protection and shall be wired into the control panel.

6. Provide a sensor to detect moisture in the stator housing of all pumps.

7. Motors shall have a maximum rotating speed of 1,800 RPM.

8. Motors shall be 3-phase, 60 Hz, 230/460 volt electric current.

B. Cable

1. Cable shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors.

2. The cable entry sealing fitting shall relieve stress on conductors and provide a watertight and submersible seal, without the use of sealing compounds and without the application of specific torques to connectors. The conductors shall connect to a terminal board which shall be provided with a moisture-tight seal between the cable entry junction chamber and the motor.

2.04 CONTROLS

A. Supplier: All controls specified shall be furnished by the pump manufacturer.

B. Pump Control Panel

1. Furnish a complete pump control package for each station, as specified below, and in Table 4.3.1 and as associated with the combustible gas detector.

2. Power Supply: Power supply shall be as shown in Table 4.3.1. Each control panel shall have a main disconnect switch. All controls shall operate on 120 volts maximum. Provide a suitably sized control power transformer, 120/240 volt secondary, with primary and secondary overcurrent protection. Provide control power transformer spare capacity and 2 pole, 240 volt breaker sized per Table 1 to supply generator accessories, or minimum 3 kVA spare capacity for installations with no on-site generator. In addition, provide 4-20 amp 1 pole breakers to supply other station auxiliary devices. Equip one auxiliary circuit with front panel On/Off selector (area light).

3. Provide motor protection relay for each phase to protect the motor against phase loss, undervoltage, overvoltage, phase unbalance and phase reversal.

4. Starters: NEMA rated, circuit breaker combination type, with overcurrent protection in each phase. Interrupting capacity is a minimum of 25,000 amperes symmetrical. Starters are reduced voltage type, either autotransformer (set on 80 percent tap) or solid state.

5. Surge Protection: Equip each panel with main panel protection equal to Advanced Protection Technologies TE Thousand Series.

6. Relays: Heavy duty industrial control type, 10 amp 600 volt reversible contacts, equal to Square D Class 8501 Type X.

7. Programmable Logic Controller (PLC): At the manufacturer's option a PLC may be used to accomplish control logic. Provide a minimum of 10 percent spare I/O points, interposing relays as specified above for external status/control signals, and hand held programmer. Acceptable manufacturers are Allen-Bradley, General Electric, Square D, Texas Instruments and Westinghouse.

8. Selectors and Pushbuttons: Heavy duty, oil-tight with octagonal ring.

9. Provide a means to automatically transfer service to the on-site generator or manually transfer service to the generator receptacle, as appropriate.

10. Indicating Lights: Heavy duty, oil-tight, transformer type with lens colors as follows:

COLOR	FUNCTION
Red	Motor Run
Green	Motor Stop
Blue	Call to Run
Amber	Alarm/Fault
White	Control Power On

11. Panel Construction: Route all wiring in Panduit or similar wireways. Protect all wiring across panel hinges. Provide numbered terminal strips for all field wiring terminations. Use barriers to separate 480 volt from 120 and lower voltage sections.

12. Provide accommodations for combustible gas detector specified in this Section.

13. Control panel shall be free-standing suitable for pad mounting.

C. Alarm Horn: Alarm horn shall be weatherproof, flush-mounted on side end of the control panel, and shall be equal to Federal Signal Model 350.

D. Alarm Light: Shall be NEMA 4X red, weatherproof, flush-mounted on top of the control panel, and shall be equal to Model LRX-40 as manufactured by Ingram Products.

E. Enclosures: Control panels shall be housed in NEMA 3R rated enclosure. The enclosure shall provide temperature and climate control suitable for the equipment furnished in the enclosure.

F. Liquid Level Sensors: Level sensing and monitoring shall be accomplished utilizing a MultiTrode probe, specifically designed for wastewater applications. Ten (10) sensors will be spaced along the length of the probe assembly, and each will be individually connected to a correspondingly numbered PVC/PVC .75mm

flexible cable. The probe cable shall be run in a separate conduit away from any high voltage cables. The cable will be encoded with number and text along the entirety of the cable and at intervals not greater than 200mm, for identification. The flexible cables shall be capable of supporting the weight of the probe and cable, without the need for additional support. The cable shall be secured to the top of the probe by a synthetic rubber compression fitting. The probe shall be mounted and installed per the manufacturer's specifications.

G. Downloadable Control/Communicator

1. Provide one downloadable control/communicator in each pumping station control panel. Provide 12 volt, 6 ampere-hour battery back-up. The unit shall be configured to automatically notify BCWSS operating personnel of the following conditions:

   a. High Wet Well Level

   b. Loss of normal electrical power (from automatic transfer switch, normally open contact close on loss of utility power., as applicable)

   c. Low Wet Well Level

2. The Contractor shall arrange with the local telephone company to provide voice-grade dial-up telephone line to the pumping station. The telephone line shall terminate within the control panel in close proximity to the downloadable control/communicator.

2.05 ACCESSORIES

A. Lifting Cable

1. Provide each pump with a minimum of four feet of galvanized steel lifting chain fitted to the top of each pump. Size chain for a minimum of 75 percent greater than the pump weight.

2. Provide nylon road and lifting device equal to Flygt's "Grip Eye" system. The length of rope shall accommodate wet well depth.

B. Aluminum Floor Doors: Provide as specified in Article 4.1 of these Specifications.

C. Combustible Gas Detector

1. Provide a location on the control panel uni-strut for a combustible gas detector (CGD) at each pump station.

2. The Contractor shall provide a 2-inch conduit between the wetwell and the future CGD analyzer.

3. Power for the CGD analyzer shall be provided from the mini power zone.

PART 3 EXECUTION

3.01 INSTALLATION

A. Equipment Installation: All equipment shall be installed in accordance with approved shop drawings, the manufacturer's recommendations and these Specifications.

B. Anchorage: Stainless steel anchor bolts, nuts and washers, as well as any templates necessary for setting the anchorage, shall be furnished by the equipment manufacturer. Placement of the anchor bolts shall be done by the Contractor from certified dimension shop drawings supplied by the equipment manufacturer.

C. Leveling and Grouting

1. Level and align pump and motor in accordance with the respective manufacturer's published data.

2. Grout pump and discharge base with non-shrink grout in accordance with the ACI and the equipment manufacturer's and grout manufacturer's published specifications.

D. Floor Doors: Floor doors shall be integrally cast into the top of the manhole. The pump manufacturer shall verify the size and location with the Contractor prior to installation of each floor door. Floor doors shall be cast into concrete in accordance with the manufacturer's recommendations.

E. The wet well is classified Class I, Division 1, Group D. Therefore, perform all electrical work in accordance with Article 5.01 of the National Electrical Code, including sealing off conduit air tight.

3.02 INSPECTION AFTER TESTING

Following installation, operating tests will be performed demonstrating to the Engineer that each mechanism and the system as a whole will function in a satisfactory manner. The Contractor shall make, at Contractor's own expense, all necessary changes, modifications and/or adjustments required to ensure satisfactory performance.

3.03 CLEANING

Prior to acceptance of the work of this Section, thoroughly clean all installed materials, equipment and related areas.

Table 4.3.1 - Submersible Pump Requirements	
Pumping Station Name	
Rated Capacity, gpm	
Rated TDH, feet	
Maximum Runout Head, feet	
Maximum Capacity at Runout, gpm	
Minimum Shutoff Head, feet	
Motor Voltage/Phase	230/3 or 460/3
Motor Horsepower	
Diameter Solids Handled, inches	3
Type of Control	Duplex
Pump and Power Cable/NEC Classification	Class I, Division 1, Group D
Control Panel Enclosure Type	SS NEMA 3R
Junction Box Type	SS NEMA 4X
Control Panel Designation	CP-*
Level Controls	
Type	Ultrasonic
Low Water Level Alarm	Yes
All Pumps Off	Yes
Lead Pump On	Yes
Lag Pump On	Yes
High Water Level Alarm	Yes
Miscellaneous Control Features	
Elapsed Time Meter for Each Pump	Yes
Alarm Light on Top of Control Panel	Yes
Alarm Horn w/Silence Button on Exterior of Control Panel	Yes
Pump No. 1 Run Light	Yes
Pump No. 2 Run Light	Yes
Pump No. 1 Failure Light	Yes
Pump No. 2 Failure Light	Yes
Pump No. 1 High Temperature Fault Light	Yes
Pump No. 2 High Temperance Fault Light	Yes
Pump No. I Moisture Light	Yes
Pump No. 2 Moisture Fault Light	Yes

Table 4.3.1 - Submersible Pump Requirements (cont.)	
H-O-A Switch	Yes
Automatic Pump Alternation	Yes
Pump Sequence Selector	Yes
Lightning Arrestor with Surge Capacitor	Yes
115 Volt Duplex Utility Outlet	Yes
Site Light On/Off Switch	Yes
Adjustable (5-120 sec) Time Delay Relay in Lag Pump Starting Circuit	Yes
Alarm Hom and Alarm Light shall be Activated Simultaneously When any of these Faults Occur	Low Wet Well Level
	High Wet Well Level
	Pump Moisture Faults
	Pump Temperature Faults
	Pump Failures

* To be determined by Developer's design Georgia registered professional engineer and which must meet the approval of Barrow County.

END OF SECTION

SECTION 4.4 - EMERGENCY BYPASS PUMPS

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 and operable installation of pumps used for bypassing flows during emergency situations when the submersible pumps in the wet well are out of service or unable to keep up with incoming wastewater flows. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications and the manufacturer's recommendations.

B. Associated wet well, piping, valves, valve vault and other appurtenances shall be as specified elsewhere in the Standard Specifications and Details.

1.02 QUALIFICATIONS

The bypass pump shall be a Godwin model manufactured by Xylem Water Solutions USA, Inc.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

A. The suction and discharge piping for the bypass pump shall be ductile iron pipe, the size to be determined by the design characteristics of the pumping system.

B. Bypass Pump Features

1. Critically Silenced Enclosure: The entire pump and engine assembly shall be completely enclosed with sound attenuated panels.

2. Dry running oil bath mechanical seal.

3. Diesel or natural gas powered engine (to be determined by the County based on the availability of natural gas near the pump station location).

4. Prime Guard engine control with floats.

5. Solar Battery Charger.

6. 110 Volt A75 Block Heater.

7. 110 Volt Junction Box.

8. Skid mounted with 100-gallon fuel tank and lifting bracket.

C. Bypass Pump Telemetry System

1. The Contractor shall provide a Mission Communications Field RTU Model M112 with NEMA 4x enclosure with the following features:

   a. Include 8 digital inputs

   b. 2 analog inputs

   c. 1 electronic key reader

   d. 3 outputs

2. The Contractor shall provide a Missions Communications Solar Cell Kit Model M800 with stand.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Bypass Pumping System shall be connected to the wetwell and valve vault as shown in the Standard Details and as follows:

1. The suction line shall be ductile iron pipe that will enter the wetwell at a minimum depth of two feet below grade.

2. The suction line will extend downward inside the wetwell to the "pumps off" elevation for the pump station

3. The suction line shall be installed below grade to the bypass pump, then extend 90 degrees vertically to connect to the suction inlet of the bypass pump.

4. The discharge piping shall be ductile iron pipe.

5. The discharge pipe will connect to the pump outlet and extend 90 degrees vertically downward to a depth of two feet below grade.

6. The discharge piping shall extend a minimum two feet below grade to the valve vault, where it will connect to the header for the duplex pump station.

END OF SECTION

SECTION 4.5 - PUMPING STATION WATER SERVICE

PART 1 GENERAL

1.01 SCOPE

A. The work covered by this Section includes furnishing all materials and equipment, providing all required labor and installing water service to a wastewater pumping station and all appurtenant work.

B. Water meters are not to be furnished by the Contractor. However, the water meter connection must be compatible with the water meters currently used by BCWSS.

1.02 LOCATIONS

Locations shall be as shown on the Drawings and in accordance with the Standard Details.

PART 2 PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE

A. Pipe

1. All PVC pipe shall have integral belled ends for push-on type jointing and shall conform to ASTM D 2241.

2. Unless shown otherwise on the Drawings, pipe shall have a Standard Dimension Ratio (SDR) of 26 and shall be capable of withstanding a working pressure of 160 psi, unless indicated otherwise on the Drawings.

3. Pipe shall be supplied in minimum lengths of 20 feet.

B. Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSF Approved".

2.02 METER BOX

A. Meter boxes shall be plastic. Material shall meet or exceed the following:

1. Tensile Strength: 3,400 psi (ASTM D 638).

2. Flexural Modulus: 191,000 psi (ASTM D 790).

3. Impact Strength, Izod: 0.6-feet 16/inch (ASTM D 256).

4. Deflection Temperatures: 200 degrees F (ASTM D 648).

B. Plastic meter boxes shall be equal to DFW Plastics, Inc., Model DFW1200TT.

C. Meter box shall be fitted with plastic cover equal to DFW Plastics, Inc. Model DFW1200-1.

D. Minimum dimensions shall be 12-5/16 x 17 9/16 inches top and 21-13/16 x 16-9/16 inches at bottom and 12 inches deep.

2.03 VALVES

Gate valves shall be bronze, heavy duty, rising stem, wedge type with screwed or union bonnet. Valve ends shall be threaded or solder type as appropriate. Valves shall have a minimum 200 psi working pressure for water (125 psi working pressure for steam). Valves shall be made in the U.S.A. Gate valves shall be equal to Crane No. 428 (threaded) or Crane No. 1334 (solder end).

2.04 CORPORATION COCKS AND CURB STOPS

A. Corporation cocks and curb stops shall be ground key type, shall be made of bronze conforming to ASTM B 61 or B 62, and shall be suitable for the working pressure of the system. Ends shall be suitable for grip type joint. Threaded ends for inlet and outlet of corporation cocks shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ANSI B16.26.

B. Corporation cocks and curb stops shall be manufactured by Mueller or Ford.

2.05 SERVICE CLAMPS

A. Clamp body shall be of epoxy coated ductile iron.

B. The strap shall have a minimum width of 3-1/4-inches and shall be made of epoxy coated stainless steel.

C. Service clamps shall be equal to Ford FC 202

2.06 BACKFLOW PREVENTERS

A. Backflow preventer shall be reduced pressure zone type (RPZ), 3/4 to 2 inch size. Locate backflow preventers where noted on the Drawings and in accordance with the Standard Details.

B. Backflow preventers shall be rated for operation with inlet water pressures up to 175 psig and water temperatures up to 140-1/2 degrees F. Backflow preventers shall be tested and certified in accordance with ASSE 1013 and AWWA C506 and C511

C. Provide with bronze body construction, rubber check valve and relief valve assemblies, and Clecon check seats.

D. Provide isolation valves on the inlet and outlet of each backflow preventer for maintenance. These valves shall be quarter turn, full port, resilient seated, bronze ball valves.

E. Provide bronze ball body valve test cocks.

F. Provide bronze body strainer on the inlet of each backflow preventer.

G. Acceptable Manufacturers: Watts Series 909, Wilkins, Hersey.

2.07 POST HYDRANTS

Post hydrants shall be non-freeze design, bronze exposed head with aluminum casing guard and bronze casing. Minimum depth of bury shall be two feet. Post hydrants shall be equal to Zurn Z-1385.

PART 3 EXECUTION

3.01 CONNECTIONS TO WATER MAINS

A. Connections to ductile iron pipe water mains shall be by the direct tap method or service clamp in full accordance with AWWA requirements.

B. Connections to polyvinyl chloride pipe water mains shall be made using a full body service clamp.

C. Pressure ratings shall be as required for the installation.

3.02 WATER SERVICE CONNECTIONS

A. Water service connections installed under roadway shall be pulled through a bored hole approximately equal in diameter to the external diameter of the service line. No casing will be required. Minimum cover under roadway shall be four feet. At other locations minimum cover shall be two feet.

B. Installation shall conform to the details for water service connections appearing schematically on the Drawings. Contractor shall provide any and all appurtenant work required to provide the intended water service connections.

3.03 PERMANENT WATER SERVICES

A. Each new service line shall be tapped into the main through a corporation stop, utilizing a service clamp. A new service line shall be provided to the meter.

B. A corporation cock shall be provided in the water main for each service line.

C. A curb stop shall be provided at each existing or future water meter location.

3.04 BACKFLOW PREVENTER LOCATIONS

Backflow preventers shall be provided on all water services.

END OF SECTION

END OF ARTICLE