

01 00 00

GENERAL REQUIREMENTS AND SUMMARY OF WORK

1. GENERAL

1.01 SCOPE OF WORK

- A. The work shall consist of furnishing all labor, materials, equipment, and incidentals required in performing all operations in connection with the sanitary sewer pipeline, in its entirety as shown on the Drawings and specified herein.
- B. All work shall be completed in strict accordance with the plans and specifications.
- C. The payment and description for unit price items can be found in Measurement and Payment.

1.02 PROGRESS OF THE WORK

- A. The work shall be started within 10 days following the Notice to Proceed, and the work shall be executed with such progress as required to prevent any delay to the general completion of the project.
- B. Contractor shall immediately notify Engineer/Owner of any delay or issue that will impact Contractor's ability to meet scheduled completion date.
- C. Contractor shall coordinate all testing, inspecting, disinfection, and startup activities with the Owner.

1.03 PRECONSTRUCTION CONFERENCE

- A. A preconstruction conference shall be held as soon as possible after the Award of Contract and before work is started.
- B. The conference will be held at a location selected by the Owner and will be attended by the Owner, Engineer, and Contractor.

1.04 WORK INCLUDED

- A. These specifications govern the construction, repair, and rehabilitation of sanitary pipelines, service lines, and manholes either by the Utility or its Contractors.
- B. These Specifications are written in imperative and abbreviated form. The imperative language is directed at the Contractor, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings.

1.05 DEFINITIONS

- A. Engineer – CWB Engineers, Inc.
- B. Provide - Furnish and install, complete in place, operating, tested and approved.
- C. Products - The materials, systems, and equipment provided by the Contractor.

1.06 BACKFILLING AND INSPECTION

- A. Gravel shall be delivered to the line segment and/or open trench where construction is occurring. No hauling of gravel with backhoe or loader from stockpile is allowed. Gravel shall be dumped at the site of backfilling. Hauling of gravel is to be by dump truck only.

1.07 PERMITS, TRAFFIC PLANS AND BARRICADE

- A. All road closures, permits, barricade and traffic plans shall be provided to RPR and/or Engineer prior to commencing construction. The contractor shall provide the documentation 3 days prior to commencing construction.

1.08 CORE DRILLING AND SEALING PENETRATIONS

- A. Existing structures such as wet wells, manholes, vaults, pre-cast concrete structures, and other concrete structures shall be cor drilled for new pipe penetrations. All penetrations shall have a mechanical seal, Linke Seal, or pre-approved.

1.09 EXCAVATOR SAFETY

- A. Contractor shall limit the personell on any excavation equipment to the driver only, no passengers will be acceptable.

01 20 00

MEASUREMENT AND PAYMENT

1. GENERAL

- A. It is the intent of the Unit Price Bid Schedule that aggregate bid amounts as submitted shall cover all costs for labor, material, equipment, and any other items incidental to the unit price items, even if not specifically listed below.
- B. No costs in connection with work required by the Contract Documents for proper and successful completion of the Contract will be paid outside of or in addition to prices submitted.
- C. Each Bid item will be measured and paid for by the units constructed within the various classifications for which prices are stated in the Unit Price Bid Schedule.
- D. Quantities are based on estimates only.
- E. All pipe installed shall be paid by linear footage. The bid item pertaining to each pipe installed shall be paid at 80% until new/replaced manholes are installed, existing manholes are grouted, lower 18" are complete, services reinstated, and the post CCTV is submitted, reviewed, and approved. The RPR and/or Engineer reserves the right to waive this requirement.
- F. Final surface restoration shall be completed as soon as possible. If the area of disturbance is past 60 calendar days, the contractor shall address the areas prior to commencing additional excavation.

2. UNIT PRICE ITEMS

2.01 MOBILIZATION

- A. The Bid Amount for this item shall include the following:
 - 1. All preparatory work and operations necessary for movement of personnel, equipment, supplies, and incidentals to the Project Site.
 - 2. Establishment of temporary offices, storage buildings, sanitary facilities, and other facilities necessary to undertake the Project.
 - 3. Work and operations which must be performed, or for expenses incurred, prior to beginning work on the Project.
 - 4. Any preconstruction cost (not including bidding cost) not directly attributable to other pay items in this Section.
- B. Mobilization shall be measured and paid by Lump Sum. Payment shall be based on the percentage of Total Contract Price Completed. The amount of Mobilization paid and when are shown below:

First Request	25% of Mobilization
10% Total Contract Price Completed	50% of Mobilization
25% Total Contract Price Completed	100% of Mobilization

Total Contract Price Completed shall be actual construction completed and does not include materials stored.
- C. The amount bid for Mobilization should not exceed five (5) percent of the Total Contract Amount listed in BID FORM. Should the amount entered in the Bid Form

for this item exceed 5%, the Owner will reduce the bid item for "Mobilization" to the maximum allowed amount, pay for the work in accordance with the schedule in this section, and pay the remaining amount over the maximum allowed on the Final Payment Request.

2.02 CLEAN AND TV MAINS (PRE-CONSTRUCTION)

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to clean and televise the existing sewer line in accordance with the Contract Documents.
 - 2. Heavy cleaning and root removal to assure a clear and accurate representation of the sewer main segment.
 - 3. Bypass pumping as necessary to remove the flow from the segment.
 - 4. Traffic Control as required.
 - 5. Televising of line segment by CCTV and compiling an accurate log of all service locations and any defects shown in the pipe segment.
 - 6. Provide Owner with copy of televised line segment and log.
 - 7. Anything incidental to this bid item that is necessary to clean and televise existing sewer line according to the Contract Documents.
 - 8. Pre-construction TV is not required and will not be paid on lines that are being open cut relayed in the same trench.
- B. Measurement and payment shall be made by the linear foot according to the various sizes and types listed in the Bid Proposal. Measurement shall be made of the actual linear footage of sewer main segment televised as measured horizontally from center of manhole to center of manhole at ground level. Payment shall be made after Engineer has reviewed and accepted the DVD/Thumb Drive and log for both pre and post CCTV.

2.03 SOLID SOD AND TOPSOIL REPLACEMENT

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to install topsoil and new solid sod surfacing, including removal of existing ground cover and soil, excavating, safety/protection, base compaction, fertilizer, water and site cleaning.
 - 2. Type of sod to be installed shall be equal to the existing sod removed unless stated otherwise in the Contract Documents.
 - 3. Anything incidental to this bid item that is necessary to complete the installation of the solid sod according to the Contract Documents.
- B. Solid sod installation shall be measured and paid by the square yard for each square yard of sod installed as directed by the Engineer. Maximum dimensions used in determining quantities shall be the width and the length of the permanent and temporary easements as shown in the Contract Documents. Actual sod installation may be greater due to safety requirements. Any additional sod installation over the maximum dimensions shall be at the Contractor's expense. No payment shall be made under this item for any sod installation over the maximum dimensions allowed unless specifically designated by the Engineer/Owner.

2.04 HYDRO-MULCHING

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to install topsoil (if necessary) and Hydromulch, including removal of existing ground cover and soil, excavating, safety/protection, base compaction, fertilizer, water and site cleaning.
 - 2. Type of hydro-mulch to be installed shall be in accordance with the technical specifications.
 - 3. Anything incidental to this bid item that is necessary to complete the installation of the Hydro-mulch according to the Contract Documents.
- B. Hydro-mulch installation shall be measured and paid by the square yard for each square yard of hydro-mulch installed. Maximum dimensions used in determining quantities shall be the width and length of the permanent and temporary easements as shown in the Contract Documents. Actual hydro-mulch installation may be greater due to safety requirements. Any additional hydro-mulch installation over the maximum dimensions shall be at the Contractor's expense. No payment shall be made under this item for any hydro-mulch installation over the maximum dimensions allowed unless specifically designated by the Engineer/Owner.

2.05 FENCE/WALL REMOVAL & REPLACEMENT

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to remove and replace any existing fences or walls, as required.
 - 2. Types of fences and walls to be removed and replaced are to be field verified by contractor.
 - 3. All fence or wall material, fence posts, bricks, concrete blocks, natural stone, concrete, reinforcing bars, gravel, and forming material.
 - 4. Fences and Walls shall be replaced to their original or better condition. If this cannot be accomplished with the fence or wall material removed, new material shall be purchased and installed at no additional cost.
 - 5. Anything incidental to this bid item that is necessary to complete the removal and replacement of Fences and Walls according to the Contract Documents.
- B. Fence/Wall Removal and Replacement shall be measured and paid by the linear foot according to the various types of fences and walls removed and replaced. Measurement of the Fence and Wall Removed and Replaced shall be made horizontally along the centerline of the fence or wall removed and replaced to the nearest 0.1 linear foot. No payment will be made for removal of a fence or wall that is not replaced.

2.06 CURB AND GUTTER REPLACEMENT

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to replace the Curb and Gutter.

2. Concrete, joint material, reinforcement, removal and disposal of existing curb and gutter, any required excavation, fine grading, backfilling, finishing and curing of the concrete.
 3. Anything incidental to this bid item that is necessary to complete the Replacement of the Curb and Gutter.
 4. Contractor shall notify RPR or Engineer to view the existing curb. In certain instances, the curb may be left in place and base material be compacted under the existing curb. Base material shall be placed mechanically or by hand for proper compaction. Voids under existing curb is unacceptable. Each existing curb cut left in place shall be on a case by case basis. Contractor shall accept responsibility for any settlement of curb if left in place.
- B. Curb and Gutter Replacement shall be measured and paid by the linear foot. Measurement of the Curb and Gutter Replaced shall be made to the nearest 0.1 linear foot.

2.07 STANDARD MANHOLE, 0'-6' DEPTH

- A. The bid amount for this item shall include the following:
1. All labor, equipment, and materials necessary to build, complete and in place, a new manhole.
 2. All excavation, removal of existing manhole, shoring, dewatering, manhole materials, forms, installation, manhole ring and cover, backfill, and Class 7.
 3. Diameter of Manholes to be constructed shall be as shown in Bid Form and on the Plans.
 4. Anything incidental to this bid item that is necessary to complete the Manhole according to the Contract Documents, including all testing procedures.
- B. Manholes shall be measured and paid individually for each manhole installed. Manholes 0' to 6' shall be paid as a unit. This item does not cover any additional depth over 6'. Depth measurement shall be made vertically from the lowest flowline to the top of the manhole ring.

2.08 STANDARD MANHOLE, ADDITIONAL DEPTH

- A. The bid amount for this item shall include the following:
1. All labor, equipment, and materials necessary to build, complete and in place, the portion of the new manhole over 6' in height.
 2. All excavation, shoring, dewatering, manhole materials, forms, backfill.
 3. Diameter of Manholes to be constructed shall be as shown in Bid Form and on the Plans.
 4. Anything incidental to this bid item that is necessary to complete the extra depth for the Manhole according to the Contract Documents.
- B. Additional depth for a Manhole shall be measured and paid by the vertical foot rounded up to the nearest tenth of a foot for each foot of manhole installed above 6'. Measurement shall be made vertically from the rim of the completed manhole to the lowest flowline and the portion from 0' to 6' subtracted. This item does not cover the section of the Manhole from 0' to 6' or the ring and cover.

2.09 4"/6" SERVICE REINSTATEMENT RELAY/INSTALL PIPE MAIN

- A. The bid amount for this item shall include the following:
 - 1. All labor, tools, equipment, materials, identification and location of live services, disconnection of live services from proposed abandoned lines, excavation for external reconnection of live services, shoring, dewatering, tap if required, service saddle, 10 linear feet of service line pipe, bedding, concrete around tap, fittings, backfilling, and cleanup. Anything over 10 linear feet of 4"/6" service line will be paid separately under 4"/6" Additional Service Lateral and should not be considered under this item.
 - 2. All reinstatements on Relay/Install Pipe shall be reinstated using a Wye.
 - 3. Anything incidental to this bid item that is necessary to reinstate the existing sewer service to the new sewer main according to the Contract Documents.
 - 4. Traffic Control as required.
 - 5. All necessary backfill material required to backfill the trench to its original or planned elevation, including Class 7 Backfill for Paved Area Repairs.
- B. Contractor shall try to rehab sewerlines during regular work hours. Contractors shall contact homeowners prior to rehab work to notify them to not use sanitary sewer while rehab is in progress. If this cannot be avoided, then the line shall be plugged and sewer pumped to nearest downstream manhole.
- C. Reinstatement of the existing live sewer service into the new sewer main shall be measured and paid individually for each live service reinstatement made.

2.10 4"/6" ADDITIONAL SERVICE LATERAL

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to replace over 10 linear feet of Service Line.
 - 2. All excavation, rock excavation, blasting, necessary permits from governmental agencies, shoring, dewatering, removal of excess material, protection barricades, traffic control, warning lights, signage, bypass pumping or temporary bypass lines required for the trenching and backfill required to install the Service Line.
 - 3. All service line pipe, fittings, installation of pipe, cutting of pipe, and connection of pipe to existing pipe or structure.
 - 4. All necessary backfill material required to backfill the trench to its original or planned elevation, including Class 7 Backfill For Paved Area Repairs.
 - 5. Service Lines will be extended across all streets to the property line.
 - 6. Anything incidental to this bid item that is necessary to complete the Service Line according to the Contract Documents.
 - 7. Machinery and equipment to pipeburst existing service lateral.
- B. 4"/6" Additional Service Lateral shall be measured and paid by the linear foot. Measurement of the Service Line shall start a distance of ten (10) feet measured horizontally from the sewer main or manhole and will be made horizontally along the centerline of the trench as the pipe is laid.

2.11 ASPHALT STREET REPAIRS

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to repair (remove and replace) the asphalt surface as shown in accordance with the Contract Documents.
 - 2. All saw cutting, excavation, barricades, signage, warning lights, asphalt, concrete base, compaction of subbase and base material, removal of old material, tack coat, temporary repair materials, cleanup, and striping of roadway, if required.
 - 3. All labor, equipment, and materials necessary to install Asphalt Pavement in accordance with the Contract Documents and the City's Specifications and Details for Street Repairs.
 - 4. Anything incidental to this bid item that is necessary to complete the repair of the asphalt surface according to the Contract Documents and the City's Specifications and Details for Street Repairs.
 - 5. Any concrete needed for street repair shall be measured and paid under Concrete Cap Street Reparis.
- B. Asphalt repair shall be measured and paid by the SY for each SY of asphalt repaired for the trench width from sawcut to sawcut, regardless of repair option chose. Overlay options will ony be paid per SY of trench cut/repair. Maximum dimensions used in determining quantities shall be as shown in the Contract Documents. Actual asphalt replacement may be greater due to safety requirements. Any additional asphalt repair over the maximum dimensions shall be at the Contractor's expense. No payment shall be made under this item for any asphalt repair over the maximum dimensions allowed unless specifically designated by the Engineer/Owner.

2.12 ASPHALT /ALLEY/DRIVE/PARKING REPAIR

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to repair (remove and replace) the asphalt surface shown in accordance with the Contract Documents.
 - 2. All saw cutting, excavation, barricades, signage, warning lights, asphalt, compaction of subbase and base material, removal of old material, tack coat, temporary repair materials, cleanup, and striping, if required.
 - 3. All labor, equipment, and materials necessary to install Asphalt Repair in accordance with the Contract Documents.
 - 4. Anything incidental to this bid item that is necessary to complete the repair of the asphalt surface according to the Contract Documents.
 - 5. Concrete cap for alley/drive/parking shall be included in this bid item.
- B. Asphalt repair shall be measured and paid by the square yard for each square yard of asphalt repaired. Maximum dimensions used in determining quantities shall be as shown in the Contract Documents. Actual asphalt replacement may be greater due to safety requirements. Any additional asphalt repair over the maximum dimensions shall be at the Contractor's expense. No payment shall be made under

this item for any asphalt repair over the maximum dimensions allowed unless specifically designated by the Engineer/Owner.

2.13 CONCRETE DRIVE/ALLEY/PARKING/SIDEWALK REPAIR

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to repair (remove and replace) the concrete surface shown in accordance with the Contract Documents.
 - 2. All saw cutting, excavation, barricades, signage, warning lights, concrete, joint material, compaction of subbase and base material, removal of old material, tack coat, temporary repair materials, cleanup, and striping of roadway, if required.
 - 3. Anything incidental to this bid item that is necessary to complete the repair of the concrete surface according to the Contract Documents.
- B. Concrete repair shall be measured and paid by the square yard for each square yard of concrete repaired. Maximum dimensions used in determining quantities shall be as shown in the Contract Documents. Actual concrete replacement may be greater due to safety requirements. Any additional concrete repair over the maximum dimensions shall be at the Contractor's expense. No payment shall be made under this item for any concrete repair over the maximum dimensions allowed.

2.14 GRAVEL DRIVE REPAIRS

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to repair (remove and replace) the gravel surface shown in accordance with the Contract Documents.
 - 2. All excavation, barricades, signage, warning lights, gravel, compaction of subbase and base material, removal of old material, temporary repair materials, and cleanup.
 - 3. Anything incidental to this bid item that is necessary to complete the repair of the gravel surface according to the Contract Documents and the City's Specifications.
- B. Gravel repair shall be measured and paid by the square yard for each square yard of gravel repaired. Maximum dimensions used in determining quantities shall be as shown in the Contract Documents. Actual gravel replacement may be greater due to safety requirements. Any additional gravel repair over the maximum dimensions shall be at the Contractor's expense. No payment shall be made under this item for any gravel repair over the maximum dimensions allowed unless specifically designated by the Engineer/Owner.

2.15 GRAVITY SEWER PIPE

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to install the Gravity Sewer Pipe.

2. All pipe, fittings, installation of pipe, cutting of pipe, and connection of pipe to existing pipe or manhole. Trenching and Backfill will be paid separately and should not be considered under this item.
 3. Traffic Control, as required.
 4. Anything incidental to this bid item that is necessary to complete the installation of the gravity pipeline according to the Contract Documents.
 5. When tying to a existing manhole contractor must repair and patch the lower 18" of Manhole and Inverts after install is complete. Contractor is responsible for ensuring pipe is sealed, and standard bench and trough is constructed (min ¾ pipe).
- B. Gravity Sewer Pipe shall be measured and paid by the linear foot according to the various sizes and types listed in Bid Form. Measurement of the Gravity Sewer Pipe shall be made horizontally along the centerline of the trench as the pipe is laid, gravity sewer shall be measured from center of manhole to center of manhole.

2.16 FORCEMAIN SEWER PIPE

NOTE TO CONTRACTOR: CONTRACTOR MAY CHOOSE TO INSTALL PORTIONS OF THE FORCE MAIN USING HORIZONTAL DIRECTIONAL DRILLING USING HDPE DR 11 DIPS PIPE. REFER TO SECTION 330523.15, PART 3.04. IN THAT CASE THE FORCE MAIN SECTION WILL BE PAID PER LINEAR FOOT AT THIS UNIT PRICE FOR OPEN CUT FORCEMAIN SEWER PIPE. ADDITIONAL BID ITEMS THAT WOULD HAVE BEEN REQUIRED FOR THE OPEN-CUT INSTALLATION WILL ALSO BE PAID. THE ANNULAR SPACE BETWEEN THE PIPE AND BOREHOLE MUST BE GROUTED AFTER PULL-BACK OF THE PIPE. SUBMIT PROPOSED GROUT PRODUCT FOR THIS APPLICATION WITH BID. SUBMIT BORING PLAN AND INDICATE PULL LENGTHS WITH BID. OTHERWISE INSTALL FORCEMAINS VIA OPEN CUT AS DESCRIBED BELOW:

- A. The bid amount for this item shall include the following:
1. All labor, equipment, and materials necessary to install the Forcemain Sewer Pipe.
 2. All pipe, fittings, installation of pipe, cutting of pipe, and connection of pipe to existing pipe or manhole. All excavation, except rock excavation, necessary permits from governmental agencies, shoring, dewatering, removal of excess material, removal and disposal of existing pipe, bypass pumping or temporary bypass lines required for the trenching and backfill required to install the proposed pipe.
 3. Repair of storm drains or culverts damaged during the construction process.
 4. All necessary backfill and bedding material required to backfill the trench to its original or planned elevation, including Class 7 Backfill For Paved Area Repairs.
 5. Locate and expose utilities that may interfere with the installation process. Any utility repairs resulting from the construction process shall be considered with this item.

6. Site restoration and cleanup. Cleanup shall include restoration of any shrub, tree, or vegetation damaged during construction process. Contractor is responsible for replacing any shrubs, vegetation, or trees up to 4" in diameter. Sod and grass will not be considered under this item and will be paid under a separate item.
 7. Barricade plan and traffic control as approved by City– Public Works.
 8. Coordination with project residences and businesses, including any temporary access easements.
 9. Traffic Control, as required.
 10. Anything incidental to this bid item that is necessary to complete the installation of the gravity pipeline according to the Contract Documents.
 11. When tying to a existing manhole contractor must repair and patch the lower 18" of Manhole and Inverts after install is complete. Contractor is responsible for ensuring pipe is sealed, and standard bench and trough is constructed (min ¾ pipe).
- B. Forcemain Sewer Pipe shall be measured and paid by the linear foot according to the various sizes and types listed in Bid Form. Measurement of the Forcemain Sewer Pipe shall be made horizontally along the centerline of the trench as the pipe is laid.

2.17 TRENCHING AND BACKFILL

- A. The bid amount for this item shall include the following:
1. All labor, equipment, and materials necessary to construct and backfill the trench as required to install the proposed gravity pipe.
 2. All excavation, rock excavation, blasting, necessary permits from governmental agencies, shoring, dewatering, removal of excess material, removal and disposal of existing pipe, protection barricades, traffic control, warning lights, signage, bypass pumping or temporary bypass lines required for the trenching and backfill required to install the proposed pipe.
 3. Repair of storm drains or culverts damaged during the construction process.
 4. All necessary backfill and bedding material required to backfill the trench to its original or planned elevation, including Class 7 Backfill For Paved Area Repairs.
 5. Locate and expose utilities that may interfere with the installation process. Any utility repairs resulting from the construction process shall be considered with this item.
 6. Site restoration and cleanup. Cleanup shall include restoration of any shrub, tree, or vegetation damaged during construction process. Contractor is responsible for replacing any shrubs, vegetation, or trees up to 4" in diameter. Sod and grass will not be considered under this item and will be paid under a separate item.
 7. Barricade plan and traffic control as approved by City– Public Works.

8. Coordination with project residences and businesses, including any temporary access easements.
 9. Traffic Control, as required.
 10. Anything incidental to this bid item that is necessary to complete the trenching and backfill according to the Contract Documents.
 11. Class 7 backfill for paved area repairs, including compaction, filter fabric (if required), and cleanup, shall be included in this bid item.
- B. Trenching and Backfill shall be measured and paid by the linear foot according to the various depths of trench listed in Bid Form. Measurement of the Trenching and Backfill shall be made along the centerline of the trench as the sewer pipe is laid, with measurements being continuous through manholes. Depth of trench shall be made by scaling the profiles for the sewer main as shown in the Contract Documents prepared by the Owner after field surveys. Depth of trench shall be defined as the distance from the “ground line” to the “invert grade”. No payment will be made for the additional depth of cut required to facilitate the placement of bedding material.

2.18 BORE WITH HDPE ENCASEMENT PIPE

- A. The bid amount for this item shall include the following:
1. All labor, equipment, and materials necessary to install the HDPE Encasement Pipe and Bore according to the Grade and Elevations shown in the Contract Documents.
 2. All excavation, except rock excavation, necessary permits from governmental agencies, shoring, dewatering, removal of excess material, protection barricades, traffic control, warning lights, signage, bypass pumping, trenching and backfilling , and the actual bore.
 3. Size of HDPE Encasement Pipe shall be as shown in Bid Form.
 4. All encasement pipe, installation of encasement pipe, cutting of pipe, welding of pipe, and sealing the ends of the encasement.
 5. All necessary backfill material required to backfill the excavation to its original or planned elevation.
 6. Anything incidental to this bid item that is necessary to Bore with HDPE Encasement Pipe according to the Contract Documents.
 7. The carrier pipe shall be included in this bid item. The carrier pipe shall be the length of the casing pipe.
- B. Bore with HDPE Encasement Pipe shall be measured and paid by the linear foot. Measurement of the Bore with HDPE Encasement Pipe shall be made horizontally along the centerline of the installed encasement pipe.

2.19 ENCASEMENT PIPE

- A. The bid amount for this item shall include the following:
1. All labor, equipment, and materials necessary to install proposed pipe through Encasement Pipe according to the Grade and Elevations shown in the Contract Documents.
 2. All excavation, except rock excavation, necessary permits from governmental agencies, shoring, dewatering, removal of excess material, protection barricades, traffic control, warning lights, signage, bypass

- pumping, trenching and backfilling , and the laying and installing of encasement pipe.
3. Size of Encasement Pipe shall be as shown in Bid Form and Plans.
 4. All encasement pipe, installation of encasement pipe, cutting of pipe, welding of pipe, and sealing the ends of the encasement.
 5. All necessary backfill material required to backfill the excavation to its original or planned elevation.
 6. Anything incidental to this bid item that is necessary to lay and install Encasement Pipe according to the Contract Documents.
 7. The carrier pipe shall be included in this bid item. The carrier pipe shall be the length of the casing pipe.
- B. Encasement Pipe shall be measured and paid by the linear foot. Measurement of the Encasement Pipe shall be made horizontally along the centerline of the installed encasement pipe.

2.20 ACCEPTANCE INSPECTION BY CCTV

- A. The bid amount for this item shall include the following:
1. All labor, equipment, and materials necessary to clean and televise the rehabilitated sewer line in accordance with the Contract Documents.
 2. Cleaning, as necessary, to provide a clear and accurate representation of the sewer main segment.
 3. Bypass pumping as necessary to remove the flow from the segment.
 4. Traffic Control, as required.
 5. Televising of line segment and compiling an accurate log of all service locations and any defects shown in the pipe segment.
 6. Providing Owner with copy of televised line segment and log.
 7. Anything incidental to this bid item that is necessary to test or inspect the rehabilitated sewer line according to the Contract Documents.
- B. Measurement and payment shall be made by the linear foot at the price shown in the Bid Proposal. Measurement shall be made of the actual linear footage of sewer main segment as measured horizontally from center of manhole to center of manhole at ground level. Payment will not be made until Engineer has reviewed and accepted the DVD/Thumb drive and CCTV log submitted.

2.21 ABANDON/REMOVE MANHOLES

- A. The bid amount for this item shall include the following:
1. All labor, equipment, and materials necessary to abandon/remove manholes, as detailed on the drawings and specifications.
 2. All material, backfill, grout, piping, sealing ends of abandoned sewer main, and any required excavation or backfilling.
 3. Anything incidental to this bid item that is necessary to abandon/remove Manholes according to the Contract Documents.
- B. Abandon/remove manholes shall be measured and paid for each manhole that is abandoned and/or removed.

2.22 ABANDON SANITARY SEWER LINES

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to grout fill and/or plug abandoned lines as shown on plans.
 - 2. All grout, concrete, piping, fittings, sealing ends of abandoned sewer main, vent pipes, and any required excavation or backfilling to fully fill and/or plug abandoned line.
 - 3. Anything incidental to this bid item that is necessary to complete the abandoning of sanitary sewer lines according to the Contract Documents and Plans.
- B. Grout Filling and/or Plugging Abandoned Lines shall be measured and paid by lump sum as listed in the Bid Form.

2.23 CLEARING AND GRUBBING

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to clear and grub any trees and brush in the easement to make pipe installation possible.
 - 2. Easement clearing shall include clearing and grubbing of all vegetation, trees, and shrubs in the existing sewer easement in a safe manner and legal removal of the debris from the site.
 - 3. Easement clearing shall be coordinated with Owner, Engineer, and Property Owners prior to any work.
 - 4. Anything incidental to this bid item that is necessary for the Clearing and Grubbing part of the Project according to the Contract Documents, the Contractor, the Owner, or the Engineer.
- B. Clearing and Grubbing shall be measured and paid by Lump Sum. Payment made each Pay Request shall be equal to the percentage of total Contract Price completed at the time of the Pay Request. Total Contract Price completed shall be the actual construction complete and does not include materials stored. No additional payment will be made under this item due to any additions in the Contract Documents.

2.24 TRENCH & SAFETY SYSTEMS

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to comply with all Safety Standards in the Contract Documents and governmental agencies having jurisdiction over the project.
 - 2. Anything incidental to this bid item that is necessary for the Safety of the Project according to the Contract Documents, the Contractor, the Owner, or the Engineer.
- B. Safety shall be measured and paid by Lump Sum. Payment made each Request shall be equal to the percentage of total Contract Price completed at the time of the Request. Total Contract Price completed shall be the actual construction complete and does not include materials stored. No additional payment will be made under

this item due to any additions in the Contract Documents. **Contractor is solely responsible for the safety of the Project.**

2.25 TRAFFIC CONTROL & BARRICADE PLAN

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to comply with all Traffic Control Standards according to the Contract Documents.
 - 2. Anything incidental to this bid item that is necessary for the Traffic Control & Barricade Plan of the Project according to the Contract Documents.
- B. Traffic Control & Barricade Plan shall be measured and paid by Lump Sum. Payment made each Estimate shall be equal to the percentage of total Contract Price completed at the time of the Estimate. Total Contract Price completed shall be the actual construction complete and does not include materials stored. No additional payment will be made under this item due to any additions in the Contract Documents.

2.26 SWPPP - STORMWATER CONTROLS

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to implement the Storm water Pollution Prevention Plan shown in accordance with the Contract Documents.
 - 2. The Contractor is responsible for all posting, signage, record-keeping, and additional requirements of the SWPPP.
 - 3. The Contractor shall follow all SWPPP guidelines and BMP's. Contractors shall comply with all ADEQ requirements during construction. No work shall be started on the project until an approved SWPPP is in place.
 - 4. The Contractor shall include costs for implementing the SWPPP requirements under the section in the bid proposal.
 - 5. Contractor is responsible for any fines imposed on Owner resulting from Contractor's failure to properly implement, maintain, or document stormwater controls. Fines will be deducted from Contractor's pay.
- B. Stormwater Controls shall be measured and paid by Lump Sum. Payment made each Request shall be equal to the percentage of total Contract Price completed at the time of the Request. Total Contract Price completed shall be the actual construction complete and does not include materials stored. No additional payment will be made under this item due to any additions in the Contract Documents. Contractor is solely responsible for implementing all Stormwater Controls.

2.27 12" RIP RAP

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to install 12" Rip Rap material shown along creek bank as shown in accordance with the Contract Documents.
 - 2. All 12" Rip Rap, compaction, filter fabric (if required), and cleanup.

3. Anything incidental to this bid item that is necessary to install the Rip Rap according to the Contract Documents.
- B. Rip Rap shall be measured by the cubic yard. Maximum dimensions used in determining quantities shall be as shown in the Contract Documents. Any additional Rip Rap required over the maximum dimensions shown shall be at the Contractor's expense. No payment shall be made under this item for any Rip Rap installation over the maximum dimensions allowed. Rip Rap must be installed at the proper depth, as shown on plans/details.

2.28 PVC INSIDE DROP

- A. The bid amount for this item shall include the following:
1. All labor, equipment, and materials necessary to build, complete and in place, the PVC inside drop for a drop manhole.
 2. All excavation, shoring, dewatering, bypass pumping, fittings, pipe, grout, couplings, installation of drop, backfill and site restoration.
 3. Size of PVC Inside Drop to be constructed shall be as shown in Bid Form and on the Plans.
 4. Anything incidental to this bid item that is necessary to complete the inside drop according to the Contract Documents.
- B. PVC Inside Drop for a manhole shall be measured and paid by the vertical foot for each foot of drop installed according to the various sizes listed in Bid Form.

2.29 ROCK EXCAVATION

- A. The bid amount for this item shall include the following:
1. All labor, equipment, and materials necessary to remove and dispose of solid rock or rock fragments greater than 1 cu yd in volume which cannot be removed by conventional mechanical excavation equipment, defined as a $\frac{3}{4}$ cubic yard capacity hydraulic backhoe with ripping teeth, operated by a competent operator. All other excavation shall be unclassified regardless of the nature of the material encountered.
- B. Rock Excavation shall be measured and paid by Cubic Yard as listed in Section 004100 Bid Form.

2.30 COMPLETE MASTER METER AND VAULT

- A. The bid amount for this item shall include the following:
1. All labor, equipment, and materials necessary to install, complete and in place, the master meter and vault as shown on the plans.
 2. All excavation, shoring, dewatering, fittings, concrete, backfill, gravel or stone, and site restoration.
 3. Size and Type to be constructed shall be as shown in Section 004100 Bid Form, on the Plans, and as detailed in these specifications.
 4. Anything incidental to this bid item that is necessary to complete the installation of the master meter and vault according to the Contract Documents.

- B. Master Meter and Vault shall be measured and paid by the lump sum as listed in Section 004100 Bid Form.

2.31 FORCE MAIN PRESSURE TESTING

- A. The bid amount for this item shall include the following:
 - 1. All labor, equipment, and materials necessary to fill the line, conduct a leakage test, and inspect the Pipe, according to Section 5.2 of AWWA C-900 and the Contract Documents.
 - 2. Coordination and assistance required to properly test and inspect the line according to Owner/Engineer's representative.
 - 3. Owner will pay for water for testing and inspection purposes but Contractor is responsible for furnishing and installing a fill connection with RPZ Backflow Preventer, pumps, and testing apparatus.
 - 4. Owner will be present when any valves in the system are opened/closed.
- B. Force Main Pressure Testing shall be measured and paid by the lump sum as listed in Section 004100 Bid Form.

01 33 00

SUBMITTALS

1. GENERAL

1.01 SUBMITTAL PROCEDURES

- A. Five copies of submittal documents must be sent to the Engineer.
- B. Complete specifications covering any unusual or special construction procedures shall be submitted for approval and approval must be received prior to beginning any construction operations.
- C. Any product not specifically referred to in the specifications or on the drawings shall be submitted for approval.
- D. A minimum review time of one (1) week shall be required on all submittals.
- E. All Submittals shall be sent directly for approval and distribution:
- F. PDF's or digital submittals are acceptable.

Mailing and Delivery Address:

CWB Engineers, Inc.
ATTN: Engineer of Record
1915 Highway 25B
Heber Springs, AR 72543
Email: onoble@cwbenigneers.com

- G. Submit to the Engineer all materials and procedures not described in these specifications. Approval from Engineer is required prior to installation of any materials not described in these specifications.

2.01 SUBMITTAL ITEMS BY SECTION

- A. 03 30 00 - Cast In Place Concrete
 - 1. Mix Design – Concrete Plant
 - 2. Field Batch Concrete
 - 3. Reinforcement – Fiber, Steel, etc.
 - 4. Admixtures
- B. 03 60 00 - Grout Fill Abandoned Sewer Lines
 - 1. Mix Design
 - 2. Equipment for Installation
 - 3. Procedures
- C. 31 23 00 - Excavation, Backfilling, and Compaction

1. Trench Safety – Pipe Installation
2. Trench Safety – Manhole Construction
- D. 31 25 00 Sedimentation and Erosion Control
 1. Best Management Practices (BMP's) material and installation guidelines.
- E. 32 92 00 - Lawns, Grasses, and Ground Cover
 1. Varieties of grass seed
- F. 33 01 30.16 & 33 01 30.41 - Pipeline Television Inspection and Cleaning
 1. Camera equipment and cleaning equipment
 2. Software for recording
 3. Previous videos of sanitary sewer inspection
 4. Insurance coverage by sub-contractor operating under prime contractor
- G. 33 01 30.71 - Pipe Burst
 1. Polyethylene Resin
 2. Polyethylene pipe
 3. Supplier
- H. 33 05 23.15 - Utility Line Bores
 1. Casing pipe showing sizes and connection details
 2. Grade of casing pipe
 3. End Seals
 4. Casing Spacers
 5. Procedure and Equipment for lined grade
- I. 33 31 00 - Sanitary Sewer Pipelines and Fittings
 1. Pipe Type, Size, Dimensions, and Classification
 2. Wyes and Fittings
 3. Reinforced Couplings
 4. Service Saddles
- J. 33 39 13 - Manholes
 1. Manhole Ring/Lid
 2. CMA
 3. Inside Drop
 4. Non-Shrink Grout
 5. Confined Space Entry

01 50 00

TEMPORARY FACILITIES

1. GENERAL

1.01 TEMPORARY SANITARY FACILITIES

- A. Sanitary facilities will not be provided by Owner. Contractor shall provide on-site facilities or use portable facilities at Contractor's expense. Portable facilities shall be located as directed by Owner and serviced and cleaned regularly.

1.02 PROTECTION OF INSTALLED WORK

- A. Contractor is responsible for providing temporary and removable protection for installed products.

1.03 TEMPORARY ACCESS AND PARKING

- A. Contractor shall provide adequate temporary access to working areas as approved by Owner/Engineer.
- B. Contractor shall not park any vehicles on any street or private property without permission from the Owner.

1.04 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Contractor personnel shall dispose of pipe coupons, pipe cuttings, trash, garbage, and any other waste material in a bag, bin, or proper waste container. If garbage, trash, or other waste material is present in the trench or within the construction limits, the Engineer will issue a verbal stoppage of work until area is properly maintained.

1.05 REMOVAL OF FACILITIES AND FINAL CLEANUP

- A. Remove all equipment, facilities, and materials prior to final inspection.
- B. Restore existing facilities and area used during construction to original condition.

01 80 00

FINAL PRODUCT PERFORMANCE

1. GENERAL

1.01 WORK INCLUDED

- A. This Section covers the final product requirements

2. PRODUCTS – Not Used

3. EXECUTION

3.01 PRODUCT SEAL AT MANHOLE

- A. Seal of rehabilitated pipe at new and existing manholes will be inspected upon completion of each line segment and again at a final inspection prior to final acceptance of the project. No visible leaks will be allowed. Should a leak be present at any of the inspection times it will be the responsibility of the Contractor to stop the leak with a method approved by the Engineer. All retainage being held by the Owner will be retained until such time as all visible leaks have been repaired to the Engineer's satisfaction. After final acceptance of the project the seals will be inspected again within a 12 month period and any additional leaks will be repaired under the Warranty Period.

3.02 FINAL REHABILITATED PIPE PRODUCT

- A. Television Inspection - All rehabilitated pipeline sections regardless of the method used will be televised as required by these specifications. Should the television camera fail to pass smoothly and without unnecessary force through a pipeline section that section will be considered as unsatisfactory and repair of the section will be performed as required by these specifications.
- B. Mandrel Inspection – Mandrel test are not required unless RPR suspect's structural integrity is compromised. CCTV will suffice for testing. All rehabilitated pipeline sections regardless of the method used will be inspected by means of a mandrel pulled by hand through the pipeline

section at the discretion of the Engineer/RPR. The mandrel will have an outside diameter equal to approximately 80% of the original inside diameter of the pipeline section prior to rehabilitation. Should the mandrel fail to pass through the section being pulled by hand, the section will be considered as unsatisfactory and repair of the section will be performed as required by these specifications. Mandrel (80% Diameter) will be supplied by the Contractor and checked and approved by Engineer prior to performing test. Mandrel test may be made in conjunction with Television inspection if Mandrel is attached in front of camera to allow Engineer to visually see results.

C. Deformations Within The Invert Area - During the television inspection of all rehabilitated pipeline sections, the lower third of the pipe cross-section will be checked for deformations in the rehabilitated pipeline that in the opinion of the Engineer will affect the natural flow of the pipeline. Deformations will be considered any abnormal protrusion either parallel or perpendicular with the flow of the pipeline. Should any deformations be found in the lower third of the pipe cross-section, the section will be considered unsatisfactory and repair of the section will be performed as required by these specifications. Deformations caused by the original pipeline section will also not be accepted. It will be the Contractor's responsibility to identify those locations of the original pipeline that may cause such deformities and make required repairs prior to the rehabilitation process. Such repairs will be considered incidental to the price bid for rehabilitation of the pipeline section.

D. Service Reinstatements - During the final televising of the rehabilitated section, the camera shall stop and pan all services to assure the Engineer that all services have been installed properly and without visible groundwater leaks. No visible leaks will be allowed. Should a leak be present, it will be the responsibility of the Contractor to stop the leak with a method approved by the Engineer. All retainage being held by the

Owner will be retained until such time as all visible leaks have been repaired to the Engineer's satisfaction.

E. Site Cleanup - The entire construction area will be returned to near original condition including the replacement of vegetation as required by these specifications as soon as possible after final acceptance of the pipeline section has been made. No retainage will be released on the project until all areas have been restored to their original condition.

3.03 PIPELINE SECTION REPAIR

A. All sections of rehabilitated pipeline considered as unsatisfactory for any of the reasons mentioned in these specifications may be repaired as follows:

1. Open Cut Methods – Pipe will be removed and replaced with a pipe installed according to the requirements of these specifications.
2. Liner Methods - Liner will be removed and replaced with a liner installed according to the requirements of these specifications.
3. Pipe Bursting Method - Point repair area considered unsatisfactory with approved materials. Care should be taken in joining the sections of pipe to assure they are joined according to these specifications.

3.04 DEDUCTION FOR NONREPAIRED SECTIONS

A. If, at the sole discretion of the Engineer, the unsatisfactory pipe section is allowed to remain, a deduction of 30% of the bid amount for that line segment from manhole to manhole containing the unsatisfactory section will be made. The Contractor has the alternative of repairing the unsatisfactory pipe section as mentioned above if they do not want the deduction of the bid amount to occur. The alternative mentioned in this section to repairing the unsatisfactory pipeline section will be only at the Engineer's discretion and the Engineer's decision will be final.

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install cast-in-place concrete complete as shown on the Drawings and as specified herein.
- B. Furnish, as required to establish concrete mixes, all sampling and laboratory testing of products and materials performed by an independent testing laboratory engaged by and at the expense of the CONTRACTOR. Field sampling, testing, inspection and related tests will be provided by the UTILITY.

1.02 RELATED WORK

- A. Concrete formwork is included in Section 03 31 00.
- B. Concrete reinforcement is included in Section 03 32 00.
- C. Modifications to existing concrete are included in Section 03 37 50.
- D. Miscellaneous metals are included in Section 05 50 00.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01 30 00, product data and information for:
 - 1. Sources of cement, fly ash, aggregates, and batched concrete.
 - 2. Air-entraining admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.
 - 3. Water reducing admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.
 - 4. Sheet curing material. Product data including catalogue cut, technical data and conformity to ASTM standard.
 - 5. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.
 - 6. High-range water-reducing admixture (plasticizer). Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, retarding effect, slump range and conformity to ASTM standards. Identify proposed locations of use.
 - 7. Liquid curing compound. Product data including catalogue cut, technical data, storage requirements, product life, application rate and conformity to ASTM standards. Identify proposed locations of use.
 - 8. Procedures for mass concrete placement as defined in Section 3.06.9.

9. Cold and hot weather concrete placement procedures in accordance with Section 3.07.D and 3.07.E, respectively.

B. Samples

1. Fine and coarse aggregates if requested for examination by the Engineer.

C. Test Reports

1. Aggregates: Conformance to ASTM standards, including sieve analysis, mechanical properties, deleterious substance content, and mortar bar expansion test results.
2. Cement and fly ash: Conformance to ASTM standards, including chemical analysis and physical tests.
3. Concrete mixes: For each formulation of concrete proposed for use, submit constituent quantities per cubic yard, water cementitious ratio, air content, concrete slump, type and manufacturer of cement and type and manufacturer of fly ash. Provide either Paragraph a. or b., below, for each mix proposed.
 - a. Standard deviation data for each proposed concrete mix based on statistical records.

Provide the following for each strength data point used in the calculation of the standard deviation for determination of the minimum required average strength:

- i. Date of sampling and name of testing laboratory.
- ii. Name of concrete batch plant.
- iii. Water cementitious ratio.
- iv. Slump of batch.
- v. Air content of batch.
- vi. Compressive strengths of all cylinders tested at that age in that batch.
- vii. If available, temperature and unit weight of batch.

Provide data from projects not more strictly controlled than outlined in these specifications. Provide summary sheet showing all pertinent data and the computation of the standard deviation. Test results shall be within the previous 12-months.

- b. Water cementitious ratio curve for concrete mixes based on laboratory tests. Provide average cylinder strength test results at 7 and 28 days for laboratory concrete mix designs. Provide results of 14 day tests if available. Test results shall be within the previous 12-months.
4. Mix Water: Submit test reports verifying conformance with ASTM C1602 for all non-potable water used as mixing water in concrete mix designs specified herein. This requirement can be neglected if potable water sources are used as mixing water.

D. Certifications

1. Certify that admixtures used in the same concrete mix are compatible with each other and the aggregates.
2. Certify that the CONTRACTOR is not associated with the independent testing laboratory proposed for use by the CONTRACTOR nor does the CONTRACTOR or officers of the CONTRACTOR's organization have a beneficial interest in the laboratory.

3. Certificate of conformance for concrete production facilities from the NRMCA.

E. Qualifications

1. Independent Testing Laboratory
 - a. Name and address
 - b. Names and positions of principal officers and the name, position, and qualifications of the responsible registered professional engineer in charge.
 - c. Listing of technical services to be provided. Indicate external technical services to be provided by other organizations.
 - d. Names and qualifications of the supervising laboratory technicians.
 - e. Statement of conformance provided by evaluation authority defined in ASTM C1077. Provide report prepared by evaluation authority when requested by the Engineer.
 - f. Submit as required above for other organizations that will provide external technical services.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33 - Standard Specification for Concrete Aggregates.
3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
6. ASTM C138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
7. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete.
8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C156 - Standard Test Method for Water Retention by Liquid Membrane-Forming Curing Compound for Concrete.
10. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
11. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

12. ASTM C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
13. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
14. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
15. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
16. ASTM C311 - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for use in Portland Cement Concrete.
17. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
18. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
19. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
20. ASTM C1260 - Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
21. ASTM C1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
22. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.

B. American Concrete Institute (ACI).

1. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
2. ACI 232.2R - Use of Fly Ash in Concrete.
3. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete.
4. ACI 304.2R - Placing Concrete by Pumping Methods.
5. ACI 305R - Hot Weather Concreting.
6. ACI 306R - Cold Weather Concreting.
7. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
8. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures and Commentary.

C. National Ready Mixed Concrete Association (NRMCA)

1. Quality Control Manual, Section 3 - Certification of Ready Mixed Concrete Production Facilities.

- D. 2006 International Building Code (IBC).
- E. Truck Mixer Manufacturers Bureau (TMMB)
 - 1. TMMB 100 - Truck Mixer, Agitator and Front Discharge Concrete Carrier Standards.
- F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. Comply with ACI 318/ACI 350, as applicable, and other stated specifications, codes and standards. Apply the most stringent requirements of other stated specifications, codes, standards, and this Section when conflicts exist.
- B. Independent testing laboratory shall meet the requirements of ASTM E329 and ASTM C1077 and be acceptable to the Engineer. Laboratories affiliated with the CONTRACTOR or in which the CONTRACTOR or officers of the CONTRACTOR's organization have a beneficial interest are not acceptable.
- C. Use only one source of cement and aggregates for the project. Provide concrete uniform in color and appearance.
- D. At least ten working days before the first concrete placement hold a preconstruction meeting to review the requirements for concrete placement, waterstop placement, jointing, concrete curing, hot weather concreting, cold weather concreting and finishing. Review, with the attendance of the plasticizer manufacturer, the properties and techniques of batching and placing concrete containing high-range water-reducing admixture. Notify all parties involved, including the Engineer, of the meeting at least ten working days prior to its scheduled date. Prepare an agenda for the meeting. Take meeting minutes and distribute to all attendees.
- E. If, during the progress of the work, it is impossible to secure concrete of the specified workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to secure the specified properties. Make all changes so ordered at no additional cost to the UTILITY.
- F. If, during the progress of the work, the materials from the sources originally accepted change in characteristics, make, at no additional cost to the UTILITY, new acceptance tests of materials and establish new concrete mixes with the assistance of an independent testing laboratory.
- G. All field testing and inspection services and related laboratory tests required will be provided by the UTILITY. The cost of such work will be paid for by the UTILITY. Methods of testing will comply with the latest applicable ASTM methods. The following items will be tested by the UTILITY to verify conformity with this Section.
- H. Provide field testing and inspection services and related laboratory tests. Methods of testing shall comply with the latest applicable ASTM methods. The following items shall be tested to verify conformity with this Section.
 - 1. Concrete placements - compressive strength (cylinders), compressive strength (cores), slump, and air content.
 - 2. Other materials that may require field testing.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Cement: Store in weathertight buildings, bins or silos to provide protection from dampness and contamination and to prevent warehouse set.
- B. Aggregate: Arrange and use stockpiles to prevent segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding three feet in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregate.
- C. Sand: Arrange and use stockpiles to prevent contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen sand.
- D. Admixtures: Store in closed containers to prevent contamination, evaporation or damage. Provide agitating equipment to uniformly disperse ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.
- E. Fly Ash: Store in weathertight buildings, bins or silos to provide protection from dampness and contamination.
- F. Sheet Curing Materials: Store in weathertight buildings or off the ground and under cover.
- G. Liquid Curing Compounds: Store in closed containers.

PART 2 PRODUCTS

2.01 GENERAL

- A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

2.02 MATERIALS

- A. Materials shall comply with this Section and any applicable State or local requirements.
- B. Cement: Domestic portland cement conforming to ASTM C150. Cement shall be low alkali cement. Do not use air entraining cements. Cement brand must be approved by the Engineer and one brand shall be used throughout the work. Provide the following type(s) of cement:
 - 1. Class A, and B Concrete - Type I/II; or Type II
 - 2. Class A, and B Concrete - Type I, I/II or Type II with the addition of fly ash resulting in C₃A being below 8 percent of total cementitious content.
 - 3. Type III cement, limited to 8 percent C₃A, may be used for Class A and/or Class B concrete, subject to approval by the Engineer, where high-early strength concrete is deemed necessary.
- C. Aggregates:
 - 1. Fine Aggregate: Washed inert natural sand conforming to ASTM C33.

2. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to ASTM C33. Grading requirements as listed in ASTM C33, Table 2 for the specified coarse aggregate size number listed in Table 1 herein. Limits of deleterious substances and physical property requirements as listed in ASTM C33, Table 3 for severe weathering regions. Do not use coarse aggregates known to be deleteriously reactive with alkalis in cement.
 3. The fine and coarse aggregates used shall not cause expansion of mortar bars greater than 0.1 percent in 16 days when tested in accordance with ASTM C1260 and using the cement proposed for the project. If aggregates proposed for use do not meet this requirement, then satisfy either a. or b. below.
 - a. Total equivalent alkali content of the cement used shall not exceed 0.60 percent as provided in the Optional Chemical Requirements of ASTM C150.
 - b. The fine and coarse aggregates used shall not cause expansion of mortar bars greater than 0.1 percent in 16 days when tested in accordance with ASTM C1260 and using the cement and fly ash proposed for the project. The proportions of the cement-fly ash mix shall be the same as those proposed for the project.
- D. Water: Potable water free of oil, acid, alkali, salts, chlorides (except those attributable to drinking water), organic matter, or other deleterious substances. Non-potable water may be used where compliance with the requirements ASTM C1602 are shown to be satisfied. See also Item 1.03.C.4 above.
- E. Admixtures: Use admixtures free of chlorides and alkalis (except for those attributable to drinking water). The admixtures shall be from the same manufacturer when it is required to use more than one admixture in the same concrete mix. Use admixtures compatible with the concrete mix including other admixtures and made for use in concrete in contact with potable water after 30 days of concrete curing.
1. Air Entraining Admixture: Conforming to ASTM C260. Proportion and mix in accordance with manufacturer's recommendations.
 2. Water Reducing Admixture: Conforming to ASTM C494, Type A. Proportion and mix in accordance with manufacturer's recommendations.
 3. High-Range Water-Reducing Admixtures (Plasticizer): Conforming to ASTM C494, Type F resulting in non-segregating plasticized concrete with little bleeding and with the physical properties of low water/cementitious ratio concrete. The treated concrete shall be capable of maintaining its plastic state in excess of 2 hours. Proportion and mix in accordance with manufacturer's recommendations.
 4. Do not use admixtures causing retarded or accelerated setting of concrete without written approval from the Engineer. Use retarding or accelerating water reducing admixtures when so approved.
- F. Fly Ash: Class F fly ash complying with ASTM C618, including the requirements of Table 1 but with the Loss of Ignition (LOI) limited to 3 percent maximum and the optional physical requirements of Table 3. Test in compliance with ASTM C311 with a minimum of one sample weighing four pounds taken from each 200 tons of fly ash supplied for the project.
- G. Sheet Curing Materials: Waterproof paper, polyethylene film or white burlap-polyethylene sheeting, all conforming to ASTM C171.

H. Liquid Curing Compound. Liquid membrane-forming curing compound conforming to ASTM C309, Type 1-D (clear or translucent with fugitive dye) and containing no wax, paraffin, or oil. Curing compound shall comply with Federal, State and local VOC limits. Liquid curing compounds shall not impair the bond of any specified coatings or sealants to be applied to the concrete following curing.

1. Curing compounds to be used for liquid containing structures shall be NSF 61 approved, be non-yellowing, and have a unit moisture loss no greater than 0.055 gm/cm^2 at 72 hours, as measured by ASTM C156.
 - a. Liquid curing compound shall be E-Cure by SpecChem LLC, or approved equal.
2. Liquid curing compounds for non liquid containing structures shall have a minimum of 18 percent solids, be non-yellowing, and have a unit moisture loss no greater than 0.055 gm/cm^2 at 72 hours, as measured by ASTM C156.
 - a. Liquid curing compound shall be Super Aqua-Cure Vox by Euclid Chemical Company, or approved equal.

2.03 MIXES

- A. An independent testing laboratory engaged by and at the expense of the CONTRACTOR shall establish concrete mixes and perform all sampling and laboratory testing of products and materials.
- B. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce workable, durable concrete conforming to these specifications. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing free water to collect on the surface.
- C. Base concrete mixes on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if not available, develop concrete mixes by laboratory tests using the materials proposed for the work.
 1. For concrete mixes based on standard deviation data of prior mixes, submit standard deviation data of prior mixes with essentially the same proportions of the same constituents in accordance with ACI 318/350 and based on the modification factors for standard deviation tests contained in ACI 318/350.
 2. For concrete mixes developed by laboratory testing, base cementitious content of the concrete on curves showing the relation between water cementitious ratio and 7 and 28 day compressive strengths of concrete made using the proposed materials. Determine curves by four or more points, each representing an average value of at least three test specimens and one water-cementitious ratio at each age. Provide curves with a range of values sufficient to yield the desired data, including the compressive strengths specified, without extrapolation. The cementitious content of the concrete mixes to be used, as determined from the curve, shall correspond to the required average compressive strength in Table 5.3.2.2 of ACI 318/350 as applicable. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content specified in Table 1.
- D. Test the fly ash and concrete mixture to provide test data confirming that the fly ash in combination with the cement to be used meets all strength requirements and is compatible with the other concrete additives.

- E. Test aggregates for potential alkali reactivity in accordance with ASTM C1260. If initial testing indicates aggregates are not potentially reactive repeat test at 3 month intervals.
- F. Compression Tests: Provide testing of the proposed concrete mixes to demonstrate compliance with the compression strength requirements in conformity with the provisions of ACI 318/350.
- G. Entrained air, as measured by ASTM C231, shall be as shown in Table 1.
 - 1. If the air entraining agent proposed for use in the mix requires testing methods other than ASTM C231 to accurately determine air content, make special note of this requirement in the admixture submittal specified under Paragraph 1.03.
- H. Slump of the concrete as measured by ASTM C143, shall be as shown in Table 1. If a high-range water-reducing admixture (plasticizer) is used, the slump indicated shall be that measured before plasticizer is added. Plasticized concrete shall have a slump ranging from 7 to 10-in.
- I. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of the other admixture(s).

TABLE 1
CONCRETE MIX REQUIREMENTS

Class	Design Strength ⁽¹⁾		Coarse Aggregate ⁽³⁾	Cementitious Content ⁽⁴⁾		
	Cement ⁽²⁾					
A	4500	C150	67	535 min.		
B	3000	C150	57 ⁽¹⁰⁾	560 min.		
Class	W/C Ratio ⁽⁵⁾	Fly Ash ⁽⁶⁾	AE Range ⁽⁷⁾	WR ⁽⁸⁾	HRWR ⁽⁹⁾	Slump Range (in)
A	0.42 max.	Yes	3.5 to 5	Yes	Yes	3-5
B	0.54 max.	Yes	3.5 to 5	Yes	Yes	4-6

Notes:

- (1) Minimum compressive strength in psi at 28 days.
- (2) ASTM Designation; Type as specified in Section 2.02.B
- (3) Size Number in ASTM C33
- (4) Cementitious content in lb/yd³, (where fly ash is used cementitious content is defined as cement content plus fly ash content)
- (5) W/C is Water-Cementitious ratio by weight
- (6) Fly ash content in the range of 20-25 percent of the total cement content plus fly ash content, by weight
- (7) AE is percent air-entrainment
- (8) WR is water-reducer admixture
- (9) HRWR is high-range water-reducer admixture; adjust W/C ratio accordingly
- (10) Where used in confined placements, size 67 aggregate is recommended

PART 3 EXECUTION

3.01 MEASURING MATERIALS

- A. Provide concrete composed of portland cement, fly ash, fine aggregate, coarse aggregate, water and admixtures as specified and produced by a plant complying with ACI 318/350 and ASTM C94. Batch all constituents, including admixtures, at the plant. High-range water reducing admixtures may be added in the field.

- B. Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94 except as otherwise specified. Use scales last certified by the local Sealer of Weights and Measures within one year of use.
- C. Weigh cement and fly ash in individual weigh batchers that are separate and distinct from the weigh batchers used for other materials. When cement and fly ash are weighed in a cumulative weigh batcher, the cement shall be weighed first.
- D. Measure the amount of free water in fine aggregates within 0.5 percent with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as-batched on printed batch tickets.
- E. Dispense admixtures either manually using calibrated containers or measuring tanks, or by means of an automatic dispenser approved by the manufacturer of the specific admixture.
 - 1. Charge air-entraining and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device.
 - 2. Inject multiple admixtures separately during the batching sequence.

3.02 MIXING AND TRANSPORTING

- A. Provide ready-mixed concrete produced by equipment complying with ACI 318/350 and ASTM C94 and produced by a plant certified by the NRMCA. Do not hand-mix. All truck mixers shall carry a rating plate conforming to TMMB 100. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit-mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.
- B. Transport ready-mix concrete to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.
- C. Keep the water tank valve on each transit truck locked at all times. Any addition of water must be directed by the Engineer. Incorporate water directed to be added by additional mixing of at least 50 revolutions at mixing speed after the addition of all water. Meter all added water and show the amount of water added on each delivery ticket.
- D. Comply with ACI 318/350 and ASTM C94 for all central plant and rolling stock equipment and methods.
- E. Select equipment of size and design to provide continuous flow of concrete at the delivery end. Use metal or metal-lined non-aluminum discharge chutes with slopes not exceeding one vertical to two horizontal and not less than one vertical to three horizontal. Chutes more than 20-ft long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.
- F. Do not re-temper (mix with or without additional cement, aggregate, or water) concrete or mortar which has partially hardened.
- G. Handle concrete from mixer to placement providing concrete of specified quality in the placement area and not exceeding the maximum time interval specified in Paragraph 3.02 I.4. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required to avoid excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms. Remix for a minimum of 5 minutes prior to discharge or testing.

- H. Furnish a delivery ticket for ready mixed concrete to the Engineer as each truck arrives. Provide a printed record of the weight of cement and each aggregate as batched individually on each ticket. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Indicate for each batch the weight of fine and coarse aggregate, cement, fly ash, and water, moisture content of fine and coarse aggregate at time of batching, and types, brand and quantity of each admixture, the quantity of concrete delivered, the time any water is added and the amount, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of transit mix truck.
- I. Temperature and Mixing Time Control
1. In cold weather (see Paragraph 3.07D) maintain the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms as indicated in Table 3.
 2. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90 degrees F.
 3. In hot weather (see Paragraph 3.07E), cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90 degrees F. Well-crushed ice may be substituted for all or part of the mixing water.
 4. The maximum time interval between the addition of mixing water and/or cement to the batch and the final placing of concrete in the forms shall not exceed the following:

TABLE 2

<u>CONCRETE TEMPERATURE</u>	<u>MAXIMUM TIME</u>
(27 Degree C) 80 Degree F to 90 Degree F (32 Degree C)	45 minutes
(21 Degree C) 70 Degree F to 79 Degree F (26 Degree C)	60 minutes
(5 Degree C) 40 Degree F to 69 Degree F (20 Degree C)	90 minutes

If an approved high-range water-reducing admixture (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

3.03 INSPECTION AND COORDINATION

- A. Batching, mixing, transporting, placing and curing of concrete shall be subject to the inspection of the Engineer at all times. Advise the Engineer of readiness to proceed at least six working hours prior to each concrete placement. The Engineer will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing and the alignment, cleanliness and tightness of formwork. Do not place concrete without the inspection and acceptance of the Engineer.
- B. See also the requirements in Section 3.11 below.

3.04 EMBEDDED ITEMS

- A. Secure to forms as required or set for embedment as required, all miscellaneous metal items, sleeves, reglets, anchor bolts, anchors, inserts and other items furnished under other Sections and required to be embedded into concrete. Set and secure such items in the locations and alignments needed so they are not displaced by concrete placement.
- B. Clean embedded items free of rust, mud, dirt, grease, oil, ice, or other injurious contaminants.

- C. Coat or isolate all aluminum embedments to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.
- D. Do not embed piping in concrete unless shown on the Drawings.
- E. Do not embed electrical conduits in concrete unless shown on the Drawings.
- F. Pipes and conduits embedded within a slab or wall (other than those merely passing through) shall satisfy the following, unless otherwise shown on the Drawings or approved:
 - a. Maximum outside dimension of pipe or conduit shall not be greater than one third the overall thickness of the slab or wall.
 - b. Spacing of pipes or conduits shall be greater than or equal to three diameters or widths on center.
 - c. Fabricate piping and conduit such that the cutting, bending, or relocation of reinforcing steel is not required.
- G. Close open ends of piping, conduits, and sleeves embedded in concrete with caps or plugs prior to placing concrete.
- H. Ensure specified tests on embedded piping are completed and satisfactory before starting concrete placement. Ensure all mechanical or electrical tests and inspections are completed and satisfactory prior to starting concrete placement.
- I. Check location, alignment, and support of piping, electrical conduits, and other items fully or partially embedded before depositing concrete. Correct mislocated and misaligned items and secure items which have become loose.
- J. Position embedded anchor bolts using templates.
- K. Correct all embedded items not installed in the location or alignment needed or displaced by concrete placement at no additional cost to the UTILITY.

3.05 CONCRETE APPEARANCE

- A. Remix concrete showing either poor cohesion or poor coating of the coarse aggregate with paste. Reject remixed concrete showing either poor cohesion or poor coating of the coarse aggregate with paste. Make, at no additional cost to the UTILITY, changes in the concrete mix design for future deliveries only by adjusting one or more of the following if the slump is within the allowable limit, but excessive bleeding, poor workability, or poor finishing quality are observed:
 - 1. The gradation of aggregate.
 - 2. The proportion of fine and coarse aggregate.
 - 3. The percentage of entrained air, within the allowable limits.
- B. Provide concrete having a homogeneous structure which, when hardened, will have the specified strength, durability and appearance. Provide mixtures and workmanship such that concrete surfaces, when exposed, will require no finishing except as specified in Section 03350.

3.06 PLACING AND COMPACTING

A. Placing

1. Verify that all formwork completely encloses concrete to be placed and is securely braced prior to concrete placement. Remove ice, standing water, dirt, debris, and other foreign materials from forms and exposed joint surfaces. Confirm that reinforcement and other embedded items are securely in place. Have a worker at the location of the placement who can check that reinforcement and embedded items remain in designated locations and alignments while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Do not place concrete on frozen subgrade, snow, or ice.
2. Deposit concrete as near its final position as possible to prevent segregation due to rehandling or flowing. Place concrete continuously at a rate that allows the concrete previously placed to be integrated with fresh plastic concrete. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials or on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.
3. Pumping of concrete will be permitted. Use a mix design and aggregate sizes chosen for pumping and submit for approval. Do not use pipelines made of aluminum or aluminum alloy. When concrete is pumped, slump will be determined at point of truck discharge and air content will be determined at point of placement.
4. Remove temporary spreaders from forms when the spreader is no longer needed. Temporary spreaders may remain embedded in concrete only when made of galvanized steel or concrete and if prior approval has been obtained.
5. Do not place concrete for supported elements until concrete previously placed in the supporting element has attained design strength.
6. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms to bring the full surface of the mortar against the form. Prevent the formation of surface voids.
7. Slabs
 - a. After bulkheads, screeds and jointing materials have been positioned, place concrete continuously between joints beginning at a bulkhead, edge form, or corner. Place each batch into the edge of the previously placed concrete to avoid stone pockets and segregation.
 - b. Avoid delays in placement. If there is a delay in placement, spade and consolidate the concrete placed after the delay at the edge of the previously placed concrete to avoid cold joints. Bring concrete to correct level and strike off with a straightedge. Use bull- floats or darbies to smooth the surface, leaving it free of humps or hollows.
 - c. Where slabs are to be placed integrally with the walls below them, place the walls and compact as specified. Allow one hour to pass between placement of the wall and the overlying slab to permit consolidation of the wall concrete. Keep the top surface of the wall moist to prevent cold joints.
8. Formed Concrete

- a. Place concrete in forms using tremie tubes taking care to prevent segregation. Maintain bottom of tremie tubes in contact with the concrete already placed. Do not permit concrete to drop freely more than 4-ft. Place concrete for walls in 12-in to 24-in lifts, keeping the surface horizontal. If a high-range water-reducing admixture is used do not permit concrete to drop freely more than 15-ft; maximum lift thickness not to exceed 7-ft.
9. Pads (Mass Concrete Placement)
 - a. Care shall be taken during placement of concrete pads that exceed two (2) feet in thickness to ensure that internal temperatures are controlled to minimize internal stresses due to a high heat of hydration. CONTRACTOR shall attempt to pour such slabs/pads on cool days and follow applicable hot weather placing and curing procedures to keep the placed concrete cool. CONTRACTOR shall submit to the Engineer a work plan describing the methods and procedures proposed to use for mass concrete placement and curing. Mass concrete placement shall not begin until the work plan is acceptable to the Engineer.
 10. Bollards
 - a. Conform to requirements specified above for formed concrete and completely fill pipe with concrete as indicated.
 11. Thrust Blocking and Anchor Collars
 - a. Concrete for thrust blocks and anchor collars shall be placed against undisturbed soil. The excavation shall be hand shaped and free of loose material. Forms shall be used to confine the concrete in areas other than that part that is in contact with undisturbed soil in the direction of thrust.

B. Compacting

1. Consolidate concrete by vibration and puddling, spading, rodding or forking so that concrete is completely worked around reinforcement, embedded items and openings and into corners of forms. Continuously perform puddling, spading, rodding and forking along with vibration of the placement to eliminate air or stone pockets which may cause honeycombing, pitting or planes of weakness.
2. Compact all concrete with mechanical vibrators. Do not order concrete until vibrators (including standby units in working order) are on the job.
3. Use mechanical vibrators having a minimum frequency of 8000 vibrations per minute. Insert vibrators and withdraw at points from 18-in to 30-in apart. Vibrate sufficiently at each insertion to consolidate concrete, generally from 5 to 15 seconds. Do not over vibrate so as to segregate. Keep standby vibrators on the site during concrete placing operations.
4. Concrete Slabs: Vibration for concrete slabs less than 8-in thick shall be by vibrating screeds. Vibration for concrete slabs 8-in and thicker shall be by internal vibrators and (optionally) with vibrating screeds. Place vibrators into concrete vertically. Do not lay vibrators horizontally or lay over.
5. Walls and Columns: Use internal vibrators (rather than form vibrators) unless otherwise approved by the Engineer. In general, for each vibrator needed to melt down (level) the batch at the point of discharge, one or more additional vibrators must be used to densify,

homogenize and perfect the surface. Insert vibrators vertically at regular intervals, through the fresh concrete and slightly into the previous lift, if any.

6. Amount of Vibration: Use vibrators to consolidate properly placed concrete. Do not use vibrators to move or transport concrete in the forms. Continue vibration until:
 - a. Frequency of vibrator returns to normal.
 - b. Surface appears liquefied, flattened and glistening.
 - c. Trapped air ceases to rise.
 - d. Coarse aggregate has blended into surface, but has not disappeared.

3.07 CURING AND PROTECTION

A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.

B. Curing Methods

1. Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain a temperature of at least 50 Degrees F at the concrete surface for a minimum of seven days after placement. Use the following curing methods as specified:
 - a. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling or covered with saturated burlap. Begin water curing as soon as concrete attains an initial set and maintain water curing 24 hours a day. Do not permit the surface of the concrete to dry out at any time during the curing period. Temperature of curing water shall be within 20 Degrees F of the concrete temperature.
 - b. Sheet Material Curing: Cover entire surface with sheet material. Anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.
 - c. Liquid Membrane Curing: Apply over the entire concrete surface except as follows. Curing compound shall NOT be placed on any concrete surface where additional concrete or grout is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Apply curing compound as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Apply in compliance with the manufacturer's recommendations.
2. Specified applications of curing methods:
 - a. Slabs for Liquid Retaining Structures: Water curing only.
 - b. Slabs on Grade and Footings (not used to retain liquids): Water curing, sheet material curing, or liquid membrane curing.
 - c. Structural Slabs (other than Liquid Retaining Structures): Water curing or liquid membrane curing.

- d. Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the substrate: Water curing.
 - e. Formed Surfaces: None if nonabsorbent forms are left in place seven days. Water curing if absorbent forms are used. Water curing if forms are removed prior to seven days. Sheet cure or liquid membrane cure if forms are removed prior to seven days. Exposed horizontal surfaces of formed walls or columns shall be water cured for seven days or until next placement of concrete is made.
 - f. Surfaces of Concrete Joints: Water curing or sheet material curing.
 - g. Mass placements: Water curing or sheet material curing.
- C. Protect finished surfaces and slabs from the direct rays of the sun to prevent plastic cracking, checking and crazing. Do not apply additional water to the surface of concrete to facilitate finishing.
- D. Cold Weather Concreting
1. For this Specification, "cold weather" is defined as a period when for more than three successive days, the average daily outdoor temperature drops below 40 degrees F. Calculate average daily temperature as the average of the highest and the lowest temperature during the period from midnight to midnight.
 2. Batch, deliver, place, cure and protect concrete during cold weather in compliance with the recommendations of ACI 306R and the additional requirements of this Section.
 3. Review the cold weather concreting plan at the preconstruction meeting. Include the methods and procedures for use during cold weather including the production, transportation, placement, protection, curing and temperature monitoring of the concrete and the procedures to be implemented upon abrupt changes in weather conditions or equipment failures.
 4. The minimum temperature of concrete immediately after placement and during the protection period shall be as indicated in Table 3. The temperature of the concrete in place and during the protection period shall not exceed these values by more than 20 degrees F. Prevent overheating and non-uniform heating of the concrete.

TABLE 3

Concrete Temperatures
Minimum Dimension of Section

	<u>< 12-in</u>	<u>12 to 36-in</u>
Min. concrete temperature:	55 Degree F	50 Degree F

5. Protect concrete during periods of cold weather to provide continuous warm, moist curing (with supplementary heat when required by weather conditions) for a total of at least 350 degree-days of curing.
 - a. Degree-days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (e.g., 7 days at an average 50 degrees F = 350 degree-days).

- b. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50 degrees F as 0 degrees F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.
- 6. Do not use salt, manure or other chemicals for protection.
- 7. At the end of the protection period, allow the concrete to cool gradually to the ambient temperature. If water curing has been used, do not expose concrete to temperatures below those shown in Table 3 until at least 24 hours after water curing has been terminated and air dry concrete for at least 3 days prior to first exposure to freezing temperatures.
- 8. During periods not defined as cold weather, but when freezing temperatures are expected or occur, protect concrete surfaces from freezing for the first 24 hours after placing.

E. Hot Weather Concreting

- 1. For this Specification, "hot weather" is defined as any combination of high air temperatures, low relative humidity and wind velocity which produces a rate of evaporation as estimated in ACI 305R, approaching or exceeding 0.2 pounds per square foot per hour (lb/sq ft/hr).
- 2. Batch, deliver, place, cure and protect concrete during hot weather in compliance with the recommendations of ACI 305R and the additional requirements of this Section.
 - a. Temperature of concrete being placed shall not exceed 90 degrees F. Maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall not cause loss of slump, flash set or cold joints.
 - b. Promptly deliver concrete to the site and promptly place the concrete upon its arrival at the site, not exceeding the maximum time interval specified in Paragraph 3.02.I.4. Provide vibration immediately after placement.
 - c. The Engineer may direct the CONTRACTOR to immediately cover concrete with sheet curing material.
- 3. Review the hot weather concreting plan at the preconstruction meeting. Include the methods and procedures for use during hot weather including production, placement, and curing.

3.08 REMOVAL OF FORMS

- A. Do not remove forms before the concrete has attained a strength of at least 70 percent of its specified design strength for beams and slabs and at least 30 percent of its specified design strength for walls and vertical surfaces, nor before reaching the following number of day-degrees of curing (whichever is the longer):

TABLE 4

<u>Forms for</u>	<u>Degree Days</u>
Beams and slabs	500
Walls and vertical surfaces	100

(See definition of degree-days in Paragraph 3.07D).

- B. Do not remove shores until the concrete has attained at least 70 percent of its specified design strength and also sufficient strength to support safely its own weight and the construction live loads upon it.
- C. In cold weather, when temperature of concrete exceeds ambient air temperature by 20 Degrees F at the end of the protection period, loosen forms and leave in place for at least 24 hours to allow concrete to cool gradually to ambient air temperature.

3.09 FIELD AND LABORATORY TESTS

- A. Sets of field control cylinder specimens will be taken by the UTILITY's testing laboratory inspector during the progress of the work, in compliance with ASTM C31. Take field control cylinder specimens during the progress of the work, in compliance with ASTM C31, at the point of concrete placement. The number of sets of concrete test cylinders taken of each class of concrete placed each day shall not be less than one set per day, nor less than one set for each 100 cu yds of concrete nor less than one set for each 5,000 sq ft of surface area for slabs or walls. Specimens shall be formed in 6-in diameter by 12-in long non-absorbent cylindrical molds.
 - 1. A "set" of test cylinders shall consist of four cylinders: one to be tested at seven days and two to be tested and their strengths averaged at 28 days. The fourth may be used for a special test at 3 days or to verify strength after 28 days if 28 day test results are low.
 - 2. When the average 28 day compressive strength of the cylinders in any set falls below the required compressive strength or below proportional minimum seven-day strengths (where proper relation between seven and 28 day strengths have been established by tests), change proportions, cementitious content, or temperature conditions to achieve the required strengths at no additional cost to the UTILITY.
 - 3. In the event that a set of field control cylinders are not collected on the day of concrete placement, a minimum of 3 cores shall be obtained and cured, per ASTM C42, 28 days after the concrete was placed and tested in accordance with ASTM C39 sampling standard, at no additional cost to the UTILITY. The location of the cores shall be specified by the engineer. Cores shall be of sufficient length to allow the upper 2" from each side of the cylinder to be removed, and have an overall length to core diameter ratio of 2 to 1. Concrete core locations shall be repaired in accordance with Specification Section 03740.
- B. Cooperate in the making of tests by allowing free access to the work for the selection of samples. Provide four firmly braced, insulated, heated, closed wooden curing boxes, each sized to hold eight specimens, complete with cold weather temperature and hot weather temperature control thermostat for initial curing and storage from time of fabrication until shipment to the testing lab. Protect the specimens against injury or loss through construction operations. Furnish material and labor required for the purpose of taking concrete cylinder samples. All shipping of specimens will be paid for by the UTILITY.
- C. Slump tests will be made in the field by the UTILITY's testing laboratory inspector immediately prior to placing the concrete. Such tests will be made in accordance with ASTM C143. Test slump immediately prior to placing the concrete. Test shall be made in accordance with ASTM C143. When concrete is pumped, slump will be determined at point of truck discharge. If the slump is outside the specified range, the concrete will be rejected. Slump tests shall be performed for every 30 cubic yards of each type of concrete placed each day including when test cylinders are made.
- D. Air Content: Test for air content will be made by the UTILITY's testing laboratory inspector on a fresh concrete sample, at the point of concrete placement. Air content for concrete made of

ordinary aggregates having low absorption shall be made in compliance with either the pressure method complying with ASTM C231 or by the volumetric method complying with ASTM C173. If aggregates with high absorptions are used, the latter test method shall be used. When concrete is pumped, air content will be determined at point of placement. Air content tests shall be performed for every 30 cubic yards of each type of concrete placed each day including when test cylinders are made.

3.10 FIELD QUALITY CONTROL

- A. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. The results of tests on such cores shall be the basis for acceptance, rejection or determining the continuation of concrete work. The right of the Engineer to take such cores shall not be construed as creating any obligation to take such cores, and not exercising this right to do so shall not relieve the CONTRACTOR from meeting the requirements of these Specifications.
- B. Cooperate in obtaining cores by allowing free access to the work and permitting the use of ladders, scaffolding and such incidental equipment as may be required. Repair all core holes with non-shrink grout as specified in Section 03600. The work of cutting, testing and repairing the cores will be at the expense of the CONTRACTOR if defective work is uncovered. If no defective work is found, such cost will be at the expense of the UTILITY.

3.11 SPECIAL INSPECTION

- A. The UTILITY or the registered design professional in responsible charge acting as the UTILITY's agent shall employ one or more special inspectors to provide inspections during construction.
- B. Special inspection shall be performed in accordance with Section 1704.4 and table 1704.4 of the IBC.
- C. The Engineer shall be notified when the forms are complete and ready for inspection at least 12 hours prior to the proposed concrete placement.

3.12 FAILURE TO MEET REQUIREMENTS

- A. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 1, the Engineer may require changes in proportions or materials, or both, to apply to the remainder of the work in accordance with Paragraph 1.05E. Furthermore, the Engineer may require additional curing on those portions of the structure represented by the test specimens which fall below the values given in Table 1. The cost of such additional curing shall be at no additional cost to the UTILITY. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer may require strengthening or replacement of those portions of the structure which fail to develop the required strength. Coring and testing and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be at no additional cost to the UTILITY. In such cases of failure to meet strength requirements the CONTRACTOR and UTILITY shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94. The "purchaser" referred to in C94 is the CONTRACTOR.
- B. When the tests on control specimens of concrete fall below the required strength, the Engineer will permit check tests for strengths to be made by obtaining a minimum of 3 cores drilled from the structure and cured, per ASTM C42, and tested in accordance with ASTM C39 sampling

standard. In cases where tests of cores fall below the values given in Table 1, the Engineer, in addition to other recourses, may require load tests on any one of the slabs, walls, beams, and columns in which such concrete was used. Test need not be made until concrete has aged 60 days. The Engineer may require strengthening or replacement of those portions of the structure which fail to develop the required strength. All coring and testing and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be at no additional cost to the UTILITY.

- C. Should the strength of test cylinders fall below 60 percent of the required minimum 28 day strength, the concrete shall be rejected and shall be removed and replaced at no additional cost to the UTILITY.

3.13 PATCHING AND REPAIRS

- A. It is the intent of these Specifications to require quality work including forming, mixture and placement of concrete and curing so completed concrete surfaces will require no patching or repairs.
- B. As soon as the forms have been stripped and the concrete surfaces exposed: remove fins and other projections; fill recesses left by the removal of form ties; and repair surface defects which do not impair structural strength. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.
- C. Immediately after removal of forms remove tie cones and metal portions of ties as specified in Section 03100. Fill holes promptly upon stripping as follows: Moisten the hole with water, followed by a 1/16-in brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spider web. Trowel smooth with heavy pressure. Avoid burnishing.
- D. When filling tie cone holes and patching or repairing exposed surfaces use the same source of cement and sand as used in the parent concrete. Adjust color to match by addition of white cement. Rub lightly with a fine carborundum stone at an age of one to five days if necessary to bring the surface down with the parent concrete. Do not damage or stain the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.
- E. Defective concrete and honeycombed areas: Chip down square and at least 1-in deep to sound concrete with hand chisels or pneumatic chipping hammers. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded in the parent concrete. If honeycomb exists around reinforcement, chip to provide a clear space at least 3/8-in wide all around the steel. For areas less than 1-1/2-in deep, the patch may be made in the same manner as described above for filling form tie holes, care being exercised to use adequately dry (non-trowelable) mixtures and to avoid sagging. Thicker repairs will require build-up in

successive 1-1/2-in layers on successive days, each layer being applied (with slurry, etc.) as described above.

- F. For very heavy (generally formed) patches, the Engineer may order the addition of pea gravel to the mixture and the proportions modified as follows:

<u>Material</u>	<u>Volumes</u>	<u>Weights</u>
Cement	1.0	1.0
Sand	1.0	1.0
Pea Gravel	1.5	1.5

- G. The CONTRACTOR may use a packaged patching compound, such as: Poly-Patch by Euclid Chemical Company; Emaco R310 by BASF Chemical Company; Sikatop 122 Plus by Sika Chemical Corporation or equal only if approved by the Engineer for use and for color match.

- H. See also the requirements of Specification Section 03_3750.

3.14 SCHEDULE

- A. The following (Table 5) are the general applications for the various concrete classes and design strengths:

TABLE 5
CONCRETE SCHEDULE

Class	Design Strength (psi)	Description
A	4,500	Walls, slabs on grade, equipment pads, pavement, repair areas, thrust collars, and all other structural concrete
B	3,000	Concrete duct and pipe encasement, sidewalks, thrust blocking

END OF SECTION

03 60 00

GROUT FILL ABANDONED SEWER PIPELINES

1. GENERAL

1.01 GENERAL

- A. This section covers the materials and procedures used in grout filling abandoned sewer pipelines with a lightweight, pump able cementitious mix.

1.02 SUBMITTALS

- A. Submit to the Engineer of Record for review and approval all materials and procedures to be used in grout filling of abandoned lines.

2. PRODUCTS

2.01 CEMENTITIOUS GROUT FOR PLUGGING LINES

- A. Waterstop gaskets shall be required at **ALL** manhole connections. Manhole seals shall be concrete manhole adapter by Fernco, or approved equal.
- B. The CMA shall not be cut under any circumstances.
- C. All grout for plugging lines shall be non-shrink Strong Seal QSR, Quadex Hyperform or re-approved equal.

2.02 FLOWABLE FILL FOR GROUT FILLING MAIN LINE FROM MANHOLE TO MANHOLE

- A. Flowable fill shall conform to Flowable Select Material of the Arkansas State Highway and Transportation Department's Standard Specifications for Highway Construction, latest edition.

2.03 WATER

- A. Potable water free from injurious amounts of acids, alkalis, oils, sewage, vegetable matter, and dirt shall be used.

3. EXECUTION

3.01 GENERAL

- A. Components shall be combined and thoroughly mixed in an approved mixer to a uniform pumpable mix. Equipment shall be of special design to insure proper mixing in as short of a duration as possible. A water meter or measuring tank shall be utilized to insure that a correct and consistent mix is produced for pumping and flow to fill voids. Mixing and pumping shall be continuous and at such a rate as to ensure that voids are filled prior to setting of mix. A pressure gauge shall be used to insure a continuous uniform flow of high quality grout without shutdowns or delays.
- B. A vent pipe shall be installed on all pipes being grout filled and shall be vented through manhole or extended to surface. Vent pipe is installed using concrete or non-shrink grout in existing pipe.
- C. Vent pipe shall be installed in the top of the existing pipe and shall be a minimum of 2" in diameter.

- D. Contractor shall excavate pipe if pumping operation cannot fully fill abandoned pipeline. Process shall be continued at excavated point until pipeline is fully filled.
- E. Grout shall be injected through 2" to 4" diameter pipe (injection pipe) with proper fittings.
- F. Pipe is considered filled when grout continually flows from vent pipe.
- G. Contractor shall take precautions to keep any excess grout from entering the sewer system. Any excess shall be cleaned up and removed from the system immediately.

31 11 00

CLEARING AND GRUBBING

1. GENERAL

1.01 WORK INCLUDED

- A. Clearing and grubbing for pipelines, service lines, valves, appurtenances, and incidental construction.

1.02 PROTECTION

- A. The Contractor shall comply with the Arkansas One-Call System and shall alert potentially conflicting utility systems accordingly.
- B. In all cases, the Contractor is responsible for protecting public and private property; and, protecting any person or persons who might be injured as a result of the Contractor's work.

2. PRODUCTS

Not Used

3. EXECUTION

3.01 GENERAL

- A. The Contractor shall not remove or disturb any vegetation except that required for the execution of the project.
- B. The Contractor shall limit all of his work to the areas of the easements and rights-of-way. Any and all damage by the Contractor outside of these areas shall be repaired at his own expense and to the satisfaction of the Engineer.
- C. Contractor shall remove all trees, stumps, shrubs, vegetation, debris, and any additional material that could interfere with the proper installation of the pipeline. All stumps shall be removed or grinded below existing ground surface. Contractor shall clear entire right-of-way where noted on plans.
- D. Trees, stumps, shrubs, underbrush, debris, and any additional material removed from the construction area shall be legally disposed of by the

Contractor. Contractor is responsible for all costs associated with the disposal of waste material.

- E. In undeveloped areas that have not been landscaped, it is not necessary to replace trees and shrubs unless otherwise specified in these Specifications, in the Plans, or directed by the Engineer. Seeding of the disturbed area is required.
- F. The Contractor shall stabilize all areas where ground surface has been disturbed and erosion is likely to occur.
- G. Burning of material will only be allowed with approval of City, Owner, and Engineer.

31 23 00

EXCAVATION, BACKFILLING, AND COMPACTING

1. GENERAL

1.01 WORK INCLUDED

- A. Excavation, backfilling, and compaction for sanitary sewer pipelines, service lines, manholes, waterlines, roadway, sidewalks, and other incidental construction.

1.02 PROTECTION

- A. The work included in this project may require excavation and related activities in close proximity to existing buried and aerial utility lines and facilities, such as water lines, sewer lines, storm drains, natural gas lines, electrical power lines, telephone cables, and TV cables. Where their presence is known, the approximate location of such utilities should be shown on the Drawings, but all such utilities and individual service lines are not known. The Contractor shall be aware of the potential for such utility lines to conflict with intended construction efforts, and the Contractor shall use appropriate precautionary measures to locate and protect such utility lines and services so as to avoid damage and interruptions to service.
- B. The Contractor shall contact the owners of the various existing utility lines and services as may be affected by the construction and solicit their assistance in identifying, locating, marking, and protecting these facilities prior to the beginning of any excavation or other work which might endanger the existing utilities. If such utilities are damaged or impaired because of the Contractor's actions or omissions, the Contractor shall be responsible for the cost of repairs or replacements of the affected or damaged utility or service line.
- C. The Contractor shall comply with the Arkansas One-Call System and shall alert potentially conflicting utility systems accordingly.

- D. In all cases, the Contractor is responsible for protecting public and private property; and, protecting any person or persons who might be injured as a result of the Contractor's work.

1.03 SUBMITTALS

- A. Trench Safety-Pipe Installation
- B. Trench Safety-Manhole Construction

2. PRODUCTS

2.01 EMBEDMENT MATERIALS - GENERAL

- A. Embedment materials are restricted to Class I materials as described below and in accordance with ASTM D 2487, latest edition.
- B. Gravel material for select backfill across streets, roads, driveways, and for placement of "gravel" surfaced areas, shall be Class 7 material conforming to the Standard Specifications of the Arkansas Highway & Transportation Department, latest edition.

2.02 CLASS I EMBEDMENT MATERIAL

- A. Class I embedment material shall conform to class 1A embedment materials in accordance with ASTM D 2321, latest edition. Material shall meet the grading requirements of gradation 67, commonly referred to as ASTM #67 or 3/4" concrete aggregate. Maximum aggregate size shall be 3/4 inch. This includes materials such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells.

2.03 SELECT NATIVE BACKFILL MATERIAL

- A. Select native material shall be good earth, sand, or gravel that is free from large rocks, stumps or hard lumpy materials. Never use materials of perishable, spongy or otherwise unsuitable nature as select material.

2.04 FLOWABLE FILL MATERIAL

- A. Flowable fill material for select backfill across streets, roads, and driveways shall be Flowable Select Material conforming to the Standard Specifications of the Arkansas Highway & Transportation Department, latest edition. Flowable Fill material will only be used when written permission is obtained from the Engineer or as directed by the city

Engineer or Public works director. However, flowable fill material is not required unless directed otherwise.

3. EXECUTION

3.01 EXCAVATION - GENERAL

- A. All excavation shall be carried accurately to the line and grade shown on the Plans as established by the Engineer.
- B. When excavation is carried below or beyond that required, fill the over-excavated space with compacted Class I material, or with concrete as approved by the Engineer.
- C. The Contractor shall use a trench box or provide and install shoring where necessary to protect the labor, the work, or adjacent property. Shoring shall be maintained in place until the backfill has proceeded to a point where it can be safely removed.
- D. Dewater all excavations before any construction is undertaken. Install pipe only in dry trenches. Place concrete upon dry, firm foundation material only.

3.02 DISPOSAL OF EXCAVATED MATERIALS

- A. The Contractor shall be responsible for disposal of excess material and disposal of excavated material unsuitable for backfilling.
- B. Disposal of excess material shall only be allowed on private property with written permission of the owner of the property. **A copy of the written permission must be forwarded to the Engineer.**

3.03 SEWER FLOW CONTROL

- A. **Plugging or Blocking:** A sewer line plug shall be inserted into the line upstream of the section or sections being worked. The plug shall be designed so that all or any portion of the sewerage can be released. After the work has been completed, flow shall be restored to normal.
- B. **Pumping and Bypassing:** The Contractor shall supply the pumps, conduits, and other equipment to divert the flow of sewage around the manhole section or sections in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flow plus

additional flow that may occur during a rainstorm. The Contractor shall be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum.

- C. Flow Control Precautions: When flow in sewer line is plugged, blocked, or bypassed, sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Further, precautions must be taken to insure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved. Contractor shall insure no overflows or sewer discharges occur during construction operation.
- D. The Sewer Flow Control plan shall be submitted to Engineer and written approval obtained prior to commencing work.

3.04 EXPLOSIVES

- A. Any use of explosives must be approved in advance by the Engineer.
- B. All work pertaining to the use of explosives shall be performed by qualified personnel.
- C. The Contractor shall obtain all the necessary permits from all governmental bodies. Copies of permits must be submitted to the Engineer of Record and the Contractor shall keep a copy of all permits on the job site at all times.
- D. Follow all governing OSHA safety regulations.
- E. Exercise every precaution to prevent damage to adjoining improvements or property.
- F. Always use a blasting shield or mat.
- G. Any damage to private property resulting from the use of explosives is the liability of the Contractor.

3.05 TRENCH DEWATERING

- A. Dewater all trenches to the extent that sanitary sewer pipe can be placed on a dry and firm trench bottom. Never place pipe in a wet or unstable trench. The allowable dewatering methods are:
 - 1. Well pointing; and,
 - 2. Over Excavation and Sump Pumping.Submit for approval other trench dewatering procedures.
- B. Well Pointing Procedure
 - 1. Install well points where required to keep the excavation dry and the subgrade stable.
 - 2. Install well points when the excavation is within two (2) feet of the water table.
 - 3. Provide sufficient pumping equipment, in good working order and available at all times, to remove any water that accumulates in excavations so a stable subgrade is obtained.
 - 4. Keep all dewatering equipment in continuous operation until backfill is completed.
- C. Pump, pipe, and drain all water resulting from dewatering operations in accordance with ADEQ requirements. Prevent flooding of streets or private property.
- D. In soils that cannot be properly dewatered, excavate and install Class I bedding material tamped in place to such a depth to provide a firm trench bottom.
- E. Divert surface runoff water away from the excavation. Where the excavation crosses natural drainage channels, care should be taken to prevent unnecessary damage or delays. Route diverted surface water into existing drainage structures, such as storm sewers, ditches, or streams per ADEQ requirements. Prevent flooding of streets or private property.
- F. Discharge of trench water or surface runoff into a sanitary sewer is strictly prohibited.

3.06 SHEETING AND SHORING

- A. Provide sheeting and shoring of trenches to:

1. Protect the safety of workers;
 2. Provide suitable means for constructing the sewer line;
 3. To maintain the trench free from slides or cave-ins;
 4. And, to protect public or private property, including existing utilities, buildings, streets, or other structures that are close to the trench.
- B. Follow all governing OSHA safety regulations.
- C. Keep shoring in place until the backfill has proceeded to a point where it can safely be removed.
- D. Hydraulic jacks and plywood are not allowed. Trench boxes shall be utilized for pipe laying per OSHA safety.

3.07 EXCAVATION – SEWER LINE AND STORM DRAIN TRENCHES

- A. Keep the trench widths within the limits specified below. This requirement is to avoid superimposed loading in excess of the designed and specified pipe strength; and to provide sufficient room for proper installation and bedding of sewer and storm drain pipe.

<u>Pipe Diameter (Inches)</u>	<u>Maximum Width of Trench</u>
6, 8, 10	4' - 0"
12, 14, 15, 16	4' - 6"
18, 21	5' - 0"
24, 30	5' - 6"
36	6' - 0"

- B. If necessary, to prevent sliding and caving, cut the trench banks back on a slope above an elevation two (2) feet above the outside top of the pipe to reduce the earth load on the trench sides. Never exceed the specified maximum width until 2 feet above the outside top of the pipe.
- C. Do not advance trench excavation more than three hundred (300) feet ahead of the completed pipe work and backfill.

3.08 OVER EXCAVATION

- A. Over excavate below the required subgrade only under the conditions as listed below.

1. The soil at the bottom of the trench is mucky or in such condition that it cannot be properly shaped and graded.
 2. The subgrade material is too soft to properly support the pipe.
- B. After over excavating, provide and install a fill consisting of Stone Backfill (B Stone) material thoroughly tamped into place in a maximum of twelve (12) inch lifts up to an elevation sufficient to prepare the subgrade for the particular bedding class required.

3.09 BEDDING AND BACKFILLING - GENERAL

- A. Install all sewer pipe using Class I embedment materials.
- B. It is essential that the complete backfill be done in such a manner to minimize voids in the backfill.
- C. Backfilling includes refilling and consolidating the fill in the excavation up to the surrounding ground surface or road grade.
- D. Use select native materials for backfilling in unpaved areas.
- E. Where trenches are to be located beneath existing or proposed streets, drives, and parking areas, Class 7 Gravel shall be used as the backfill material. The backfill shall be placed in 6" lifts. All backfill shall be in accordance with the regulations of the owner.
- F. Use mechanical compaction devices to compact backfill materials in trenches.

3.10 BEDDING AND BACKFILLING RIGID PIPE

- A. The intent of the bedding is to create a uniform support which will protect the pipe from localized stress points and to provide for a well graded trench bottom.
- B. Extend the trench excavation to a minimum depth of six (6) inches below the bottom of the pipe.
- C. Install bedding material in no greater than eight (8) inch lifts.
- D. Compact all bedding material to a minimum density of 95% modified proctor as outlined in AASHTO T-99.
- E. Install pipe in accordance with Sanitary Sewer Pipelines.
- F. Backfill the excavation.

3.11 BEDDING AND BACKFILLING FLEXIBLE (PVC) PIPE

- A. The intent of this bedding is to provide uniform support for the flexible pipe.
- C. Extend the trench excavation to a minimum depth of six (6) inches below the bottom of the pipe.
- D. Install bedding materials in no greater than eight (8) inch compacted lifts. Install bedding from six (6) inches below the pipe to six (6) inches above the pipe. Shovel slice bedding beneath the pipe haunches.
- E. Compact all bedding material to a minimum density of 95% modified proctor as outlined in AASHTO T-99.
- F. The maximum depth of bury for PVC pipe is sixteen (16) feet. Any depths greater than sixteen (16) feet require rigid pipe.
- G. Backfill and compact the excavation.

3.12 MANHOLE EXCAVATION

- A. Excavate the base area no larger than necessary to provide an adequate base.
- B. Dewater all excavations if required before starting any permanent construction.
- C. Provide sheeting and shoring as required.
- D. Leave at least twelve (12) inches between the outer surface of manholes and the excavation or shoring.
- E. If over excavation occurs, bring the excavation back to proper grade with either:
 - 1. Stone Backfill (B Stone) material compacted to 95% modified proctor; or,
 - 2. Concrete poured monolithically with the base.

3.13 BACKFILLING MANHOLES

- A. Do not backfill around manholes until adequate strength has been obtained from the manhole to support the backfill without damage to the manhole.
- B. Never backfill poured-in-place manholes until the concrete has cured 24 to 48 hours and/or at the discretion of the Engineer/RPR. Contractor shall

plate the manhole area in paved areas until the manhole has cured properly to remove forms.

- C. Backfill manholes with select native material compacted to a density sufficient to prevent excessive settlement.
- D. In public streets or roads, backfill and compaction requirements shall be the same as for trench crossings.

3.14 EXCAVATION, BACKFILLING, AND COMPACTION FOR SEWER FORCE MAINS

- A. Excavate trenches for force mains to:
 - 1. Provide a minimum cover of thirty (30) inches over the top of pipe barrel; and,
 - 2. Allow for the proper bedding material to be installed.
- B. Excavate trenches wide enough for pipe installation and joint makeup. The trench width at the top of the pipe must never exceed the outside diameter of the pipe plus two (2) feet.
- C. Where no bedding is required, accurately grade the trench so that the pipe will be in continuous and uniform contact with undisturbed soil for the full length of the pipe.
- D. Excavate for pipe bells to ensure a smooth bearing surface.
- E. If the soil at the bottom of the trench is mucky or unstable so that it cannot properly support the pipe, over excavate and backfill as described above for gravity pipelines.
- F. Backfill the trench and compact the materials as stated above for gravity lines.

3.15 EXCAVATION, BACKFILLING, AND COMPACTION FOR MISCELLANEOUS STRUCTURES

- A. Excavate a sufficient distance from walls and footings to allow for forms and for proper inspection.
- B. Leave at least (12) inches between the outer surface of miscellaneous structures and the excavation or shoring.

3.16 EXCAVATION, BACKFILLING, AND COMPACTION FOR SEWER SERVICE LINES

- A. Backfilling and compaction requirements for service lines shall be the same as the requirements listed above for the type of sewer pipe installed.
- B. All excavation, backfill, and compaction of sewer service lines in public right-of-way shall be made in accordance with the regulations of the owner.

SEDIMENTATION AND EROSION CONTROL

1. GENERAL

1.01 WORK INCLUDED

- A. Sedimentation and erosion control for pipelines, service lines, valves, appurtenances and incidental construction.
- B. Contractor shall install, maintain, remove, and clean up erosion and sedimentation controls as shown on the Drawings, specified herein, and included in the Stormwater Pollution Prevention Plan (SWPPP).
- C. A SWPPP is anticipated to be required for this project. The Owner/Engineer will prepare the SWPPP for use on this Project, however, the Contractor agrees to become a signatory on the plan. The Contractor further agrees to abide by the conditions of the SWPPP, furnish and install all features of the SWPPP, and amend the SWPPP as necessary to accommodate site conditions and construction elements.

1.02 SUBMITTALS

- A. Contractor shall submit a schedule for installing temporary and permanent erosion control measures.
- B. Contractor shall sign and return three (3) copies of the SWPPP to the Engineer and designate a qualified inspector responsible for performing inspections as specified in the SWPPP.
- C. Contractor shall submit any amendments as necessary to the SWPPP to prevent sediment from leaving the construction site.

1.03 REGULATORY REQUIREMENTS

- A. Contractor shall comply with the requirements of the SWPPP, the Federal Clean Water Act, and the Arkansas Water and Air Pollution Control Act 472.

2. PRODUCTS

2.01 GENERAL

- A. Products shall be as detailed and described in the SWPPP.

3. EXECUTION

3.01 GENERAL

- A. Contractor shall comply with all requirements of the SWPPP, EPA, ADEQ, and other agencies concerning stormwater and erosion controls.
- B. The National Pollutant Discharge Elimination System (NPDES) requires permit coverage in order to discharge storm water associated with construction sites into waters of the United States. This coverage within Arkansas is obtained under ADEQ General Permit ARR150000.
- C. The Owner will file a Notice of Intent (NOI) and develop a Storm Water Pollution Prevention Plan (SWPPP) for construction sites of five (5) acres or greater. The Contractor shall implement the SWPPP according to requirements of the General Permit and be prepared to install, construct, repair, and maintain erosion and sedimentation control items throughout the contract period. When the project site is stabilized per requirements of the NPDES General Permit, the Contractor shall provide written notice to the Owner. Once the site is deemed stabilized, the Owner will file the required Notice of Termination (NOT).
- D. If the Contractor fails to properly maintain, install, or construct erosion and sedimentation control items, the Owner may take the following actions: cessation of the Work, withholding of Contractors payment, suspension to the project, or default of the Contractor.
- E. Additional erosion and sedimentation control work required due to Contractors negligence, carelessness, or failure to install permanent controls as scheduled, shall be performed by the Contractor at no additional cost to the Owner. In addition, the Contractor may be assessed damages resulting from negligence in complying with the SWPPP at the rate assessed against the Owner by the permitting authority.

- F. Install and monitor a rain gauge on the construction site. Maintain a daily record of rainfall amounts.
- G. Maintain a signed copy of the SWPPP at the job-site throughout the contract period.

3.02 REMOVAL AND FINAL CLEANUP

- A. Once the site has been fully stabilized against erosion, remove sediment control devices and all accumulated silt. Dispose of silt and waste materials in a proper manner. Regrade all areas disturbed during this process and stabilize against erosion.
- B. Provide written notice to the Owner that the site has been stabilized in accordance with the SWPPP and the General Permit prior to removing temporary sediment control devices.

3.03 MAINTENANCE, REMOVAL AND RESTORATION

- A. Maintain all pollution control measures and works in a functional condition as long as needed during the construction operation. Remove all temporary measures and restore the site to as nearly original conditions as practicable.

31 37 00

RIPRAP

1. GENERAL

1.1 SECTION INCLUDES

- A. Dumped stone riprap at locations shown on Drawings.

1.2 REFERENCES

- A. Arkansas Highway and Transportation Dept. (AHTD): 1. Standard Specifications for Highway Construction, Edition of 2014, hereafter referred to as "AHTD Standard Specifications".

2. PRODUCTS

1.1 MATERIAL

- A. Stone: Stone for dumped riprap shall meet the requirements of subsections 816.02(a) and 816.02(a)(2) of AHTD Standard Specifications.

3. EXECUTION

1.1 INSTALLATION

- A. Install dumped riprap in accordance with the construction methods specified in section 816 of AHTD Standard Specifications.
- B. Maintain riprap protection until accepted, replacing displaced material.

32 12 00

FLEXIBLE PAVEMENT AND AGGREGATE SURFACING

1. GENERAL

1.01 WORK INCLUDED

- A. This section covers the materials and procedures used in the repair of roads, streets, or other public rights-of-way where a pipe line, storm drain or structure is proposed.

1.02 REGULATIONS AND STANDARDS

- A. All permanent repairs of streets, roads, or other public rights-of-way shall comply with the requirements shown in the Standard Detail Drawings. The Contractor is responsible for following the requirements of all local Ordinances, Regulations, or Codes governing the repairs to roads, streets, or other public rights-of-way. In particular:
 - 1. Repair of State Highways: per requirements of the Arkansas State Highway Commission.
 - 2. Repair of county roads: per requirements of the County Roads Department.
 - 3. Repair of city streets: per the requirements of City ordinances.
 - 4. Permit for street cut and repairs shall be obtained by the Contractor.
- B. Temporary Repairs: Per requirements of the governmental agency having jurisdiction and these specifications. A minimum of a cold mix temporary patch for all temporary repairs must be provided.

2. PRODUCTS

2.01 MATERIALS:

- A. Per the applicable standards referenced above.

3. EXECUTION

3.01 ASPHALT PAVEMENT REPAIRS

- A. Asphalt pavement shall be replaced in accordance with details shown in the Standard Details and all materials shall be furnished and installed in accordance with the Arkansas Highway and Transportation Department "Standard Specifications for Highway Construction." Before removing paved surfacing, the existing pavement shall be cut, sawed, or trimmed along straight and vertical lines. The pavement shall be cut in manner to reduce the amount of pavement repair required. The contractor will not be paid for asphalt pavement repair resulting from ripping or digging pavement that has not been properly cut, sawed, or trimmed. The condition of the backfill and base course material, with special regard to the degree of compaction, may be checked and approved by the Engineer before any surfacing is replaced.
- B. Before placement of new surface material, all excess material shall be removed to a minimum depth of ten (10) inches. A minimum of eight (8) inches of 3000 psi concrete shall be placed within two (2) inches of the

street surface and graded consistently smooth. Before placing asphalt, the concrete and sides of the cut shall be primed with MC-30 at the rate of 0.3 gallon per square yard.

- C. Minimum thickness of asphalt surface replacement shall be two (2) inches, unless shown otherwise. Hot mix asphalt material shall be delivered to the site in covered vehicles, at a 275 deg-F (minimum), and immediately spread to a thickness to match adjacent surfaces after rolling. Compaction shall be by steel-wheel roller to a smooth, uniform surface matching adjacent surfaces.
- D. Any settlement or failure of surface replacement shall be repaired or replaced by the Contractor.
- E. All pavement repairs shall be in accordance with the Standard Detail Drawings and local ordinances and regulations.
- F. All pavement markings shall be restored to new conditions per the requirements of the governmental agency having jurisdiction.

3.02 CONCRETE PAVEMENT REPAIRS

- A. Concrete pavement shall be replaced in accordance with details shown on the Drawings and all materials shall be furnished and installed in accordance with the Arkansas Highway and Transportation Department "Standard Specifications for Highway Construction." Before removing paved surfacing, the existing pavement shall be cut, sawed, or trimmed along straight and vertical lines. The contractor will not be paid for concrete pavement repair resulting from ripping or digging pavement that has not been properly cut, sawed, or trimmed. The condition of the backfill and base course material, with special regard to the degree of compaction, may be checked and approved by the Engineer before any surfacing is replaced.
- B. Before placement of concrete street material, all excess material shall be removed to a minimum depth of eight (8) inches. A minimum of eight (8) inches of 3000 psi concrete shall be placed to match the line and grade of existing street surface.
- C. Paved walkways disturbed or damaged in the process of construction shall be replaced in kind. Walkway shall be replaced to same width and thickness as original but in no case less than 4-inches thick. Joint system in replacement shall be at same style and interval as that in the undisturbed walkway.
- D. All pavement repairs shall be in accordance with the Standard Detail Drawings and local ordinances and regulations.
- E. All pavement markings shall be restored to new conditions per the requirements of the governmental agency having jurisdiction.

3.04 GRAVEL SURFACING

- A. Gravel surfacing shall be replaced to at least the compacted thickness of the original surface. All excavated material shall be removed from gravel surfaces affected by construction and sufficient new gravel material shall be placed to restore the original surfaced area.

- B. Gravel material for repair of "gravel" surfaced areas, shall be Class 7 material conforming to the Standard Specifications of the Arkansas Highway & Transportation Department, latest edition.

3.05 TEMPORARY SURFACING

- A. Comply with the requirements stated above or as otherwise approved to adequately maintain traffic and proper drainage.

3.06 TRAFFIC CONTROL

- A. Whenever traffic flow restrictions of any kind are anticipated, the Contractor will be required to contact the local authority to be given permission to obstruct traffic flow.
- B. Street closing permits must be obtained from proper government agencies.
- C. Construction signs shall be placed immediately adjacent to the Work, at such locations as traffic demands.
- D. Contractor shall notify law enforcement agencies, fire departments, and other impacted agencies and personnel.
- E. Contractor will be required to submit a barricade plan to local traffic authority and the Engineer.

SECTION 32 92 13

HYDROMULCHING

1. GENERAL

1.1 SCOPE

- A. The work to be performed under this section of the Specifications shall consist of providing ground cover by hydro-mulching. The area of hydro-mulching will include covering all areas impacted by the construction where existing grass has been killed.

1.2 DELIVERY, STORAGE AND HANDLING

- A. Deliver grass seed in original containers showing analysis of seed mixture, percentage or pure seed, year of production, net weight, date of packaging, and location of packaging. Damaged packages are not acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.3 QUALITY ASSURANCE

- A. Furnish seed labeled in accordance with current rules and regulations of Arkansas Plant Board.

2. PRODUCTS

2.1 SEED

- A. All seed shall be labeled in accordance with the current rules and regulations, and shall be free of noxious weeds. Seed shall be furnished in sealed, standard containers unless otherwise authorized by the Engineer in writing. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be acceptable. The minimum percentage by weight of pure live seed shall not be less than 85 when tested according to current regulations under the Federal Seed Act. All legumes must be inoculated with an approved culture as per the manufacturer's recommendations.
- B. Seed shall be composed of the varieties and amounts by weight as shown below.

<u>Variety</u>	<u>Time Period</u>	<u>Lbs. per Acre</u>
	March 1 - March 31	
Tall Fescue		35
Weeping Love Grass		5
Lespedeza		35

April 1 - June 15		
Weeping Love Grass	5	
Bermuda Seed - Hulled	10	
Lespedeza	35	
Bahia Seed	20	
June 16 - August 31		
Weeping Love Grass	5	
Bermuda Seed - Hulled	5	
Bermuda Seed - Unhulled		10
Brown Top Millet	15	
Bahia Seed	20	
September 1 - October 31		
Tall Fescue	35	
Rye Grass	10	
Crimson Clover	20	

2.2 MULCH

- A. For maximum soil holding ability the mulch shall be a wood cellulose fiber. This mulch shall be applied at the rate of 1200 lbs per acre on 4:1 slopes or flatter or at 1500 lbs per acre on slopes steeper than 4:1.

2.3 FERTILIZER

- A. Refer to section 32 93 00.

2.4 CONSTRUCTION METHODS

- A. The area to receive hydro-mulch shall be brought to a smooth and uniform surface to conform to an elevation 4" below the finished grade indicated on the Plans. The surface of the topsoil stockpile shall be thoroughly diced to a depth of 6" prior to loading. The topsoil shall then be dumped upon the prepared area and spread to a uniform depth of 4". Ground cover shall then be applied by hydro-mulching.

3. EXECUTION

3.1 APPLICATION

- A. Application of ground cover shall be by hydro-mulching. Apply mixture of mulch, seed, fertilizer, and water with the proper equipment to achieve complete coverage at the specified rate. Water used in hydro-mulching shall be of drinking water quality. Water used shall be at the Contractor's expense.
- B. Prior to hydro-mulching, lightly firm seeding area with a cultipacker.

3.2 WATERING

- A. After application of the mulch cover, water shall be applied as necessary to establish the grass. Fertilizer shall be commercial grade, uniform in composition, free flowing, and suitable for application with mechanical equipment, delivered to the site in labeled containers, to current Fertilizer Laws and bearing the name, trademark, and warranty of the producer.

- B. The Contractor is responsible for watering the hydro-mulch until it is established. In areas where the hydro-mulch did not establish because of insufficient watering, poor topsoil or washout, then the Contractor shall, at his own expense, correct any erosion, reapply seed and water these areas.

END OF SECTION

32 92 00

LAWNS, GRASSES, AND GROUND COVER

1. GENERAL

1.01 WORK INCLUDED

- A. This Section covers the replacement of ground cover disturbed by the construction.
- B. Consists of furnishing and applying fertilizer, seed, sod, topsoil, mulch cover, and water at all locations disturbed by the construction.
- C. Maintenance service and establishment of cover.

2. PRODUCTS

2.01 SOD

- A. Solid sod shall be cut from well-established viable Bermuda, Zoysia, or St. Augustine grass. Sod type shall match that established in the disturbed areas.

2.02 TOPSOIL

- A. Topsoil shall be reasonably free from subsoil, clay, lumps, brush, objectionable weeds and/or other litter and shall be free from roots and toxic substances or other material or substances that might be harmful to plant growth or be a hindrance to grading, planting, and maintenance operations.

2.03 FERTILIZER

- A. Fertilizer shall be a standard commercial product complying with State and Federal laws and with the requirements issued by proper authorities.
- B. Fertilizer shall be delivered to the site in the manufacturer's original container, on which shall be plainly marked the manufacturer's name and the guaranteed chemical analysis.
- C. Fertilizer shall contain not less than the percentages by weight of ingredients as follows:
 - Nitrogen - 12 percent
 - Phosphorus, P205 - 12 percent

Potash, K2 - 12 percent

- D. All fertilizer shall be solid and shall be in a condition which will permit proper distribution.

2.04 WATER

- A. Water shall be free from any substances, in solution or in suspension, which would inhibit the rapid growth of grass.

2.05 SEED AND MULCH

- A. Seed shall be composed of the varieties and amount by weight as shown below, based on time of application:

<u>February 15 - March 15</u>	<u>Lbs. Per Acre</u>
Tall Fescue (Ky. 31)	35
Weeping Love Grass (Eragrostis Curreala)	5
Lespedeza (Kobe)	35
<u>March 15 - June 1</u>	
Bermuda Grass (Common), Hulled	10
Weeping Love Grass (Eragrostis Curreala)	5
Bahia (Pensacola)	20
Lespedeza (Kobe)	35
<u>June 1 - September 15</u>	
Weeping Love Grass (Eragrostis Curreala)	5
Bermuda Seed (Common), Hulled	5
Bermuda Seed (Common), Unhulled	10
Bahia Grass (Pensacola)	20
Brown Top Millet	15
<u>September 15 - November 15</u>	
Tall Fescue (Ky.31)	35
Rye Grass (Annual)	10
Crimson Clover (Dixie)	20

- B. Mulch cover shall consist of straw. Mulch shall be dry and reasonably free from Johnson grass or other noxious weeds, and shall not be excessively

brittle or in an advanced state of decomposition. All material will be inspected and approved prior to use.

3. EXECUTION

3.01 SOD PLACEMENT

- A. Solid sod or topsoil shall not be placed until all other items of work are complete.
- B. Areas to be sodded shall be shaped in such manner that they will, after placement of sod, conform to the typical sections.
- C. Prior to placing the topsoil in the areas designated, the ground surface shall be cleared of materials that might hinder proper grading, tillage, or subsequent maintenance operations such as stumps, stones, roots, cable, wire, grade stakes, etc., and brought to four (4) inches below the finished grade. The areas shall then be thoroughly tilled to a depth of at least two (2) inches by plowing, disking, harrowing, or other acceptable means.
- D. The Contractor shall then obtain an approved topsoil from any available source and place uniformly on the designated areas and spread evenly to a minimum thickness of four (4) inches. Irregularities in the surface shall be corrected so as to prevent formation of depressions where water will stand. **TOPSOIL SHALL NOT BE PLACED WHEN THE SUBGRADE IS FROZEN, EXCESSIVELY WET, OR IN A CONDITION DETRIMENTAL TO THE PROPOSED PLANTING AND PROPER GRADING.**
- E. After the topsoil has been spread and graded, the surface shall be cleared of stones, stumps, or other objects that might hinder planting or maintenance preparations. Paved areas over which hauling operations are conducted shall be kept clean.
- F. Where any portion of the surface becomes gullied or otherwise damaged, the affected areas shall be repaired to the aforementioned condition.
- G. Fertilizer shall be applied to the loosened layers (two (2) inches deep) at the rate of one and one-half (1-1/2) pounds per 100 square feet for all

areas, regardless of whether topsoil has been added. Distribution shall be uniform.

- H. Prior to placement of sod, areas shall be sprinkled with water sufficiently to make them moist, but not muddy. The initial application of water may be omitted if the area is moist from rainfall.
- I. Immediately following the placing and tamping of sod, the covered area shall be wetted thoroughly. Subsequent applications of water shall be as required.
- J. The sodding operations shall not be considered complete until they have produced areas of living grass that have a solid root structure. The sod shall be approved and accepted by the Engineer.
- K. Immediately following the sodding operations, all gutters, sidewalks, driveways, street pavement, yard, or other areas shall be cleaned of all debris, excess sod, topsoil, or other objectionable matter. All such cleanup operations shall be completed before sodded areas are measured for payment.

3.02 SEEDING AND MULCHING

- A. Areas to be seeded shall be dressed to natural shape.
- B. Prior to placing the topsoil in the areas designated, the ground surface shall be cleared of materials that might hinder proper grading, tillage, or subsequent maintenance operations such as stumps, stones, roots, cable, wire, grade stakes, etc., and brought to four (4) inches below the finished grade. The areas shall then be thoroughly tilled to a depth of at least two (2) inches by plowing, disking, harrowing, or other acceptable means.
- C. Contractor shall then obtain an approved topsoil from any available source and place uniformly on the designated areas and spread evenly to a minimum thickness of four (4) inches. Irregularities in the surface shall be corrected so as to prevent formation of depressions where water will stand.
TOPSOIL SHALL NOT BE PLACED WHEN THE SUBGRADE IS FROZEN, EXCESSIVELY WET, OR IN A CONDITION

DETRIMENTAL TO THE PROPOSED PLANTING AND PROPER GRADING.

- D. After the topsoil has been spread and graded, the surface shall be cleared of stones, stumps, or other objects that might hinder planting or maintenance preparations. Paved areas over which hauling operations are conducted shall be kept clean.
- E. Where any portion of the surface becomes gullied or otherwise damaged, the affected areas shall be repaired to the aforementioned condition.
- F. Upon approval from the Engineer, the existing soil may be used if a proper seed bed can be obtained. The seed bed shall be thoroughly pulverized by means of disk harrows or other approved methods, thoroughly mixing soil to a depth of not less than 6 inches.
- G. Fertilizer shall be applied at the rate of 800 pounds per acre of 12-12-10, or the equivalent amount of plant food. Fertilizer shall be uniformly incorporated into the soil to a depth of at least 2 inches.
- H. Broadcast sowing of seed may be accomplished by hand seeders or by approved sowing equipment. Both methods shall result in uniform distribution, and no work shall be performed during high winds. The area seeded shall be lightly firmed with a cultipacker immediately after broadcast.
- I. Mulch cover shall be applied at the rate of 4,000 pounds per acre immediately after seeding and shall be spread uniformly over the entire area by approved poser mulching equipment.
- J. After application of the mulch cover, water shall be applied in sufficient quantity to thoroughly moisten the soil to the depth of pulverization and then as necessary to germinate the seed and maintain growth.
- K. The contractor shall water and maintain seeded areas from time of completion until final acceptance of the project.
- L. The contractor shall be responsible for establishing ground cover on all disturbed areas. Repeated seeding shall be required if necessary throughout the warranty period.

SECTION 33 01 30.13

SANITARY SEWER PIPELINE AND MANHOLE TESTING

1. GENERAL

1.01 WORK INCLUDED

- A. This section covers the inspection and testing of pipelines, manholes, and service lines. Testing is required before final acceptance of pipelines and service lines by Engineer.
- B. This section describes manhole testing to effectively confirm the watertight integrity of new manholes and existing manholes following infiltration related repairs and inflow related repairs.

1.02 SCOPE OF WORK

All pipelines shall be inspected and tested before final acceptance. The final pay estimate will not be paid until all lines are completed to the satisfaction of the Engineer and Owner. The method and extent of testing will be determined by the Engineer and Owner. All or a combination of the methods below can be used to test the new lines:

- A. New Gravity Sewer Pipelines
 - 1. Visual inspection during installation and before backfill.
 - 2. Low pressure air test.
 - 3. Television inspection.
 - 4. Mandrel test (Flexible pipes only).
 - 5. Final Visual Inspection.
 - 6. Infiltration/exfiltration if required by Engineer.
- B. Manholes
 - 1. High voltage holiday detection.
 - 2. Visual inspection during installation and before backfill.
 - 2. Vacuum testing.
 - 3. Exfiltration test.
 - 4. Final Visual Inspection.
- C. Replacement Pipelines and Point Repairs
 - 1. Visual inspection during installation and before backfill.

2. Low pressure air test.
 3. Television inspection.
 4. Mandrel test (Flexible pipes only).
 5. Final Visual Inspection.
- D. Force Mains
1. Visual inspection during installation and before backfill.
 2. Hydrostatic pressure test.
- E. Service Lines
1. Visual inspection during installation and before backfill.
 2. Low pressure air test.
 3. Exfiltration test.
 4. Television inspection for pipe bursting existing service lines.

1.03 DESCRIPTION

- A. Infiltration may be observed in manhole defects at manhole walls, pipe seals or bench/trough areas. Infiltration related repairs are intended to eliminate leakage of groundwater into manholes.
- B. Inflow may be observed in manhole defects at manhole frames, covers, frame seals, grade adjustments, grade adjustment seals, corbels, or walls. Inflow related repairs are intended to eliminate sources of surface water entry that become active during rainfall events.

1.04 GENERAL INFORMATION

- A. The testing required shall be performed by the Contractor at locations designated by the Engineer and documented to the satisfaction of the Engineer.
- B. The Contractor shall test rehabilitation work completed by the Contractor and any sub-contractor. Testing shall not be performed on a specific manhole until all work as shown on the Manhole Rehabilitation Schedule has been completed for that specific manhole.
- C. Any rehabilitated manholes or new manholes that are observed to be leaking by the Engineer shall be subject to additional repairs.

2. PRODUCTS

Not Used.

3. EXECUTION

3.01 VISUAL INSPECTION DURING INSTALLATION AND BEFORE BACKFILL

- A. The Engineer or Engineer's Representative will inspect pipelines, manholes, and service lines during all phases of construction. The level of inspection is at the discretion of the Engineer and will be based partly on the Contractor's ability, experience, and past performance. All work not conforming to these specifications that is discovered during this inspection phase will be corrected by the Contractor.

3.02 PRESSURE TEST FOR GRAVITY SEWER PIPELINES

- A. The Contractor will perform pressure tests on all gravity sewer pipelines in the presence of the Engineer or Engineer's Representative.
- B. Lines will not be accepted until they pass all required tests.
- C. Perform the tests in the presence of the Engineer or Engineer's representative. Engineer shall be notified 24 hours prior to the required testing.
- D. The primary test method is the Low Pressure Air Loss test for lines smaller than 24 inches in diameter. Under special conditions and when approved in advance by Engineer the exfiltration/infiltration test procedure may be used.

3.03 LOW PRESSURE AIR LOSS PROCEDURE FOR GRAVITY SEWER PIPELINES

- A. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
- B. Pipe air supply to pipeline to be tested so that air supply may be shut off, pressure observed, and air pressure released from the pipe without entering the manhole. Install a valved branch in the supply line past the shut-off valve terminating in a 1/4" female pipe thread for installation of the test gauge.
- C. Add air slowly to portion of pipe under test until test gauge reads at least 4 psig, but less than 5 psig.

- D. Shut air supply valve and allow at least two minutes for internal pressure to stabilize.
- E. Determine time in seconds for pressure to fall 1 psig so that pressure at the end of time of the test is at least 2.5 psig.
- F. Compare observed time with minimum allowable times in the following chart for pass/fail determination.

TEST CHART FOR AIR TESTING SEWERS

Leakage Testing of Sewers by Low Pressure Air Loss
(Time Pressure Drop Method)

Table 1 - Minimum Test Times in Seconds for 1 psig drop (2.5 psig to 3.5 psig)								
Distance Between Manholes	Nominal Pipe Diameter (inches)							
	6	8	10	12	15	18	21	24
100	40	70	110	155	245	350	480	625
150	60	105	165	235	365	500	595	680
200	80	140	220	315	425	510	595	680
250	100	176	270	340	425	510	595	680
300	120	215	283	340	425	510	595	680
350	140	226	283	340	425	510	595	680
400	160	226	283	340	425	510	595	680
450	170	226	283	340	425	510	595	680
500				340	425	510	595	680
550						510	595	680
600							595	680

NOTE: Due to force resisted by plug restraints, testing of sewers larger than 24" is not recommended.

- G. Where groundwater level is above the crown of the pipe being tested, increase test pressure at the rate of 1 psi for every 2.5 feet of water above the crown.
- H. Air Testing Safety Requirements:
 - 1. Securely brace plugs used to close the sewer pipe for the air test; this is to prevent the unintentional release of a plug which can become a high velocity projectile. For example: four pounds (gauge) air pressure develops a force against the plug in a 12"

diameter pipe of approximately 450 pounds; this force can propel a 12-inch plug weighing 10 pounds to supersonic speeds.

2. Locate gauges, air piping manifolds, and valves at the top of the ground. Entry by anyone into a manhole where a plugged pipe is under pressure is strictly prohibited.
3. Do not use the air test on gravity sewer pipes larger than 24" in diameter because of the difficulty of adequately blocking the plugs.

3.04 WATER LOSS TEST PROCEDURE

- A. Perform the water loss test procedure to determine the quality of the sewer line against infiltration and exfiltration only when specifically approved by Engineer. The Low Pressure Air Loss Test outlined above is the standard test procedure. Where approved, follow the procedure below.
- B. Infiltration Test: Minimum test time is 2 hours. The allowable pipeline leakage rate under exterior ground water pressures is:
 1. For all pipe materials: 100 gallons (or less) per inch of nominal pipe diameter per mile of pipeline per 24 hours. Submit procedure to Engineer for approval if this test is used.
- C. Exfiltration Test: This test will be used if Engineer decides the ground water table at the time of testing is too low to produce dependable results from the infiltration test. This test will not be used if Engineer decides the ground water table is too high. The allowable pipeline leakage rates are the same as stated for the Infiltration Test. Submit procedure to Engineer for approval if this test is used.

3.05 TELEVISION INSPECTION

All newly installed sewer mains shall be televised as follows:

- A. The Contractor shall clean all lines thoroughly prior to the start of televising.
- B. Each segment of pipe shall be televised.
- C. The sewer main shall be televised to reveal possible defects in material or workmanship.

- D. The Contractor shall correct any defects discovered during the television inspection at the Contractor's expense.
- E. Any televising of line segments by the Contractor will be made in the presence of the representative of the Engineer and final videos shall be delivered to the Engineer for review and approval. Engineer or Engineer's representative will be notified in advance of all televising of line segments performed by the Contractor.

3.06 MANDREL TEST (FLEXIBLE PIPE ONLY)

- A. The maximum allowable pipe deflection is five (5) percent of the inside pipe diameter.
- B. Any sewer pipe which fails the mandrel test prior to final acceptance will not be accepted by Engineer until the defects are corrected.
- C. All mandrel tests shall be performed by the Contractor while observed by the Engineer or Engineer's representative.
- D. Mandrel test are not required unless RPR suspect's structural integrity is compromised. CCTV will suffice for testing.

3.07 SUPPLEMENTAL MANDREL TESTING

- A. Owner/Engineer may at any time after final acceptance perform supplemental mandrel testing on pipelines constructed of flexible pipe material. These supplemental tests will be performed as detailed above with a maximum allowable long term deflection of five percent (5%).
- B. Any sewer pipe which fails the mandrel test prior to expiration of the maintenance bond will be corrected by the Contractor at the Contractor's expense. If the Contractor fails to correct these defects after a reasonable time, the Owner will correct the defects and file a claim with the bonding company.

3.08 FINAL VISUAL INSPECTION

- A. Upon completion of the above tests the Engineer will perform a final visual inspection of pipelines and manholes.
- B. A punch list of defects (including obvious running leaks) will be prepared and sent to the Contractor for correction at the Contractor's expense.

3.09 INSPECTION FOR SERVICE LINES

- A. All building sewer installations shall be visually inspected and approved by the Engineer or Engineer's Representative.
- B. Backfill may only be placed on the completed portions of a building sewer following inspection.
- C. All building sewers are subject to testing to insure water tightness. All tests must be performed in the presence of the Engineer or Engineer's Rep. Tests may be either by:
 - 1. Water Loss Test Procedure; or,
 - 2. Low Pressure Air Loss Procedure.
- D. Water Loss Test Procedure
 - 1. Plug the section of line to be tested at the lower end and fill section with water so that at least four (4) feet of head is obtained.
 - 2. The maximum acceptable water loss while so filled is not more than 100 gallons per twenty-four hours per inch of pipe diameter per mile of pipe. This is approximately 3/16 gallon for a one hundred (100) foot long section of four (4) inch pipe tested thirty minutes.
- E. Low Pressure Air Loss Procedure
 - 1. Plug securely both ends of the line to be tested.
 - 2. Charge the line with air to a pressure of 4.5 psig.
 - 3. Allow at least five minutes for the temperature in the pipe to stabilize.
 - 4. Measure the time required for a one (1.0) psi drop in pressure.
 - 5. The minimum time for a one psi loss is $28.5 \times d$ seconds where d = the nominal diameter in inches of the pipe being tested.

3.10 PRESSURE TEST FOR FORCE MAINS

- A. Perform hydrostatic leakage tests for force mains by filling the force main with water and increasing the pressure to a testing pressure of 150% of the working pressure with a minimum of 100 psi.

- B. The duration of the leakage test shall be two hours or as specified by the Engineer.
- C. The force main will not be accepted until the actual leakage is equal to or less than the allowable. In addition, all obvious leaks shall be repaired.
- D. The allowable leakage rate per hour for ductile iron, PVC, or polyethylene pipe shall be calculated by the following formula:

$$L = \frac{ND \times P^{.5}}{7400}$$

L = Allowable Leakage (gallons per hour)

N = Number of Joints in Pipeline Tested

D = Nominal Diameter (inches)

P = Test Pressure (psi)

3.11 MANHOLE TESTING (COATING)

- A. The contractor shall vacuum test cementitious manholes provided by RPR or Engineer.
- B. The Contractor shall test all manholes that have been epoxy coated. During application, a wet film thickness gauge, meeting ASTM D4414 standard practice for measurement of wet film thickness of organic coatings by notched gages, shall be used. Measurements shall be taken, documented and attested to by contractor and submitted to RPR.
- C. The holiday detection test for coating systems installed in corrosive environments shall be performed to ensure monolithic protection of the substrate. After the coating product has cured in accordance with manufacturers recommendations, all surfaces shall be inspected for holidays in accordance with NACE SP0188-2006 discontinuity (holiday) testing of new protective coatings on conductive substrates or ASTM D47487 standard practice for continuity verification of liquid or sheet linings applied to concrete substrates. All detected holidays shall be marked and repaired according to the coating product manufacturer's recommendations.

1. Test voltage shall be a minimum of 100 volts per mil of coating system thickness.
 2. Detection of a known or induced holiday in the coating product shall be confirmed to ensure proper operation of the test unit.
 3. All areas repaired shall be retested following cure of the repair material.
 4. In instances where high voltage holiday detection is not feasible, a close visual inspection shall be conducted and all possible holidays shall be marked and repaired as described above.
 5. Documentation of areas tested, equipment, employed, results and repairs made shall be submitted to RPR.
- D. Adhesion of the coating system to the substrate shall be confirmed in a minimum as described in the measurement and payment for epoxy coating. Testing shall be conducted in accordance with ASTM D7234 pull off adhesion strength of coatings on concrete using portable pull off adhesion testers.
1. For each test manhole a minimum of three 20mm dollies shall be affixed to the coated surface; one at the cone area, one at the mid-section and one near the bottom of the structure.
 2. For larger structures a minimum of three 20mm dollies shall be affixed to the coated surface at random locations within each 1000 square foot area or as otherwise agreed upon.
 3. The adhesive used to attach the dollies to the coating shall be rapped setting with tensile strengths in excess of at least twice the anticipated failure point (generally at least 1,000psi) and permitted to cure in accordance with manufacturer recommendations. The coating and dollies shall be adequately cleaned and prepared to receive the adhesive. Failure of the dolly adhesive shall be deemed a non-test and require retesting.
 4. Prior to performing the pull test, the coating shall be scored to the substrate, or within 10 mils of the substrate surface, by mechanical

means without disturbing the dolly or coating the system bond within the test area.

5. Two of the three adhesion pulls in each test area shall exceed 200 psi and shall include substrate adhered to the back of the dolly or no visual signs of the coating product in the test hole. Pull tests with results between 150 and 200 psi may be acceptable if more than 50 percent of the substrate in the test area is adhered to the dolly.
 6. Should a structure, or area, fail to achieve two successful pulls as described above, additional testing shall be performed at the discretion of the RPR or Engineer. Any areas detected to have inadequate bond strength shall be evaluated by the Engineer. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Contractor.
 7. All adhesion testing shall be performed by qualified personnel using calibrated equipment as specified by the applicable ASTM standard(s).
 8. All adhesion testing shall be documented and submitted in a consistent format detailing location, test values, description of the failure point/mode, scoring method employed, adhesive used, cure time of coating and adhesive and other data as deemed necessary by the Engineer.
 9. All adhesion test locations shall be repaired by the Contractor at no cost to the Owner.
- E. The Contractor shall test ring/lid replacement manholes directed by RPR or Engineer.
- F. Manholes shall be tested in accordance with ASTM C 1244-93. Vacuum test shall not be performed earlier than 7 days after construction or installation. The Contractor shall provide all testing equipment, pump,

hosing, seal, and other incidentals. Vacuum test head shall be positioned at the top of the casting (the surface on which the manhole cover rests, to include grade rings) in accordance with the equipment manufacturer's instructions. A vacuum of 10-inches of mercury shall be drawn and the vacuum pump isolated by the shut-off valve on the test head connection. When valve is closed, time measurement shall commence, and the time required for vacuum drop to 9-inches of mercury shall be observed and recorded. Manholes shall pass if the time for the vacuum reading to drop from 10-inches of mercury to 9-inches of mercury meets or exceeds the time values in seconds in the following table. The lines entering the manhole shall be temporally plugged with the plugs braced to prevent them from being drawn into the manhole. The Contractor shall spray a soap solution on the manhole wall and pipe seals to help determine leakage sites.

Depth (feet)	Diameter (inches)								
	30	33	36	42	48	54	60	66	72
<10	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	29	34	40	46	57	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	70	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

- G. Manholes showing greater than the allowable leakage shall be repaired and re-tested until a satisfactory leakage result is obtained.
- H. The Engineer will be required to certify that designated manholes on a project have been vacuum tested and have passed the test criteria. Copies of the test results will be supplied by the Contractor, if requested.

3.12 MANHOLE TESTING (RING/LID REPLACEMENT)

- A. All new manholes shall be dyed water tested in the presence of the Engineer. The dye test shall consist of applying a concentrated dye solution around the manhole frame. Dyed water shall be applied for at least ten minutes.
- B. Manholes observed to be actively leaking will have failed the test and will not be acceptable. The Contractor shall make the necessary repairs at no additional compensation. The manhole shall then be retested as described above until a successful test is made.

33 01 30.16

PIPELINE TELEVISION INSPECTION

PART 1 - GENERAL

1.01 WORK INCLUDED

This section covers the television inspection of sanitary sewer lines.

- A. The work shall consist of furnishing all labor, materials, accessories, equipment, tools, transportation, services, and technical competence for performing all operations required to professionally execute the inspection of sewers.
- B. Information concerning depths of flow, manhole depths, air quality in the sewers, accessibility of manholes, traffic conditions, and other safety considerations are the sole responsibility of the Contractor. Contractor shall obtain and incorporate the necessary provisions into the overall contract price to safely complete the specified work under the conditions existing in the sewers to be inspected.
- C. The inspection of each line shall be by a television (TV) camera especially designed to accurately show the condition of the lines from the interior and with the ability to pinpoint the locations of line faults and necessary repairs.

1.02 SUBMITTALS

- A. The Contractor shall submit for approval manufacturer's brochures and specifications for proposed TV equipment to the Engineer.
- B. The Contractor shall submit past job references and qualifications, including examples of past video and report documents, as required by Engineer.
- C. The Contractor shall submit proof of Arkansas Licensure and proof of current insurance.
- D. No work will be allowed until Engineer has received and approved all submittals.

1.03 INSPECTION

- A. All cleaning of the sewer lines shall be with a vactor truck capable of vacuuming the sediment, gravel, and debris from the manhole. No material from the contractor's lines shall be discharged downstream.
- B. Immediately upon cleaning the sewer line, it will be televised to determine the condition of the line and location of existing service connections, etc.

- C. The sewer lines shall be visually inspected by TV camera. The section being inspected shall be suitably isolated from the remainder of the sewer line, as necessary.
- D. The camera shall be moved through the line in either direction at a uniform slow rate not to exceed 60 feet per minute, by means of cable winches, or similar mechanisms. **Under no circumstances shall the camera be tethered to a hydraulically propelled or high-velocity jet cleaning device while the cleaning device is on.**
- E. The camera shall stop at each service connection and provide a view up the service line.
- F. Telephone, or similar suitable means of communications, shall be set up between the two winches, the pumping unit and the monitor control.
- G. TV inspection will be done one manhole section at a time and the flow in the section being inspected will be suitably controlled. Sewer flow will not exceed those shown below as measured in the manhole:

6" - 10" Pipe	1 inch
12" - 14" Pipe	2 inches
14" - 24" Pipe	3 inches
Over 24" Pipe	4 inches
- H. The Contractor will make all provisions for pumping or bypassing the flow around the manhole section and the cost shall be incidental to TV inspection. Contractor shall not be allowed to float the camera. Contractor shall take all necessary measures to eliminate any upstream surcharging in the system during the television inspection process.
- I. Footage shall be shown continuously on the video as measured from the center of the starting manhole to the tenth of a foot. In cases when it is impossible for the inspection equipment to pass through an entire manhole section due to damaged pipe or other obstructions, the contractor shall reset his equipment so that the inspection can begin at the opposite manhole – “reverse setup”. If the camera fails to pass through the entire manhole section after a “reverse setup”, the

Contractor shall notify the Engineer and an appropriate plan of action shall be developed.

PART 2 - PRODUCTS

2.01 TELEVISION INSPECTION EQUIPMENT

- A. The television camera and monitoring equipment shall be specifically designed and constructed to perform the work as specified. The camera shall be operative in conditions of 100% humidity and/or under water. The camera shall be small enough to pass through a 6 inch diameter sewer and shall be waterproof with a self contained lighting system capable of producing enough light to produce clear, bright, sharp pictures on the monitor. The lighting and camera quality shall be suitable to allow a clear, in focus picture of a minimum of 6 linear feet of the entire inside periphery of the sewer pipe. Picture quality and definition shall be to the satisfaction of the Engineer; otherwise, the equipment shall be removed from the line.
- B. The monitor shall be located within a temperature controlled television unit that will accommodate three people to watch the sewer line inspection. The monitor will have a 12 inch minimum viewing screen. The Engineer and Owner's representative will have access to view the television monitor at all times.
- C. The camera system shall provide a clear video to view. Pixeled video is unacceptable. Contractor shall provide software to view video if Engineer's software is unable to view the video clearly.

PART 3 - EXECUTION

3.01 GENERAL

All television inspection will be performed by Contractor.

3.02 TELEVISION INSPECTION BY THE CONTRACTOR

- A. The Contractor shall furnish videos of the lines televised to the Engineer for review and comments. The video media shall be DVD format. Software used in the creation of the video will be approved by the Engineer. Software used in viewing the video will be provided at no cost to the Engineer and Owner, if necessary. Each video media shall be permanently labeled with the following information furnished:

1. Owner
 2. Project Name
 3. Manhole to Manhole Designation
 4. Name of Contractor
 5. Date Televised
- B. The following information shall be recorded and visible onscreen for 10 seconds immediately before the start of televising each line segment:
1. Owner/Project Name
 2. Manhole to Manhole Designation (Number, Pipe Material, Size of Line, and Direction of Televising)
 3. Name of Contractor
 4. Date Televised
 5. Street or Other Location
- C. A continuous uninterrupted recording of distance from the insertion manhole shall be visible at the lower left corner of the screen at all times during inspection.
- D. The following information shall be provided in hard copy to accompany each DVD/and/or thumb drive:
1. Owner/Project Name
 2. Name of Contractor
 3. Date Televised
 4. Street or Other Location
 5. Upstream Manhole Designation
 6. Downstream Manhole Designation
 7. Pipe Material
 8. Pipe Diameter
 9. Direction of Televising (Downstream or Upstream)
 10. Location of Service Connections
 11. Location of Defects or Unusual Conditions
 12. Total Length of Segment
- E. Three complete copies of the final project reports shall be submitted to the Engineer within thirty days of completion of all field activities.

- F. Videos will become the property of the Owner. If the videos are of such poor quality that the Engineer is unable to evaluate the condition of the sewer line or to locate service connections, the Contractor will be required to retelevis and provide an adequate video of the line at no additional expense to the Owner. Any video not meeting the conditions contained within these specifications shall be retelevised at no additional expense to Owner, at the discretion of the Engineer.
- G. The report shall be in a 3 ring binder with DVD's in a jackedted cover. The hard copy shall be generated from the software utilized to video the sanitary sewer. **NO HAND WRITTEN FORMS ARE ACCEPTABLE.**
- H. The report shall indicate the pre-TV and post-TV.
- I. The report shall indicated the basin in which the line segment is located.

33 01 30.41

PIPELINE CLEANING

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. This Section covers the cleaning of sanitary sewer lines.

1.02 SUBMITTALS

- A. The Contractor shall submit for approval manufacturer's brochures and specifications for proposed cleaning equipment to the Engineer.
- B. The Contractor shall submit proposed methods and procedures for cleaning. A list of personnel with their experience shall be submitted to the Engineer.
- C. The Contractor shall submit past job references and qualifications, including examples of past video and report documents, as required by Engineer.
- D. The Contractor shall submit proof of Arkansas Licensure and proof of current insurance.
- E. No work will be allowed until Engineer has received and approved all submittals.

PART 2 – PRODUCTS

2.01 EQUIPMENT

- A. Equipment selected for cleaning shall be of a type generally recognized by the trade for the purpose being used and that has proved satisfactory. The equipment shall be capable of removing all roots, dirt, grease, rock, and other deleterious material and obstructions from the sewer lines and manholes that would prevent efficient use of the inspection equipment.
- B. Hydraulic cleaning equipment shall be of a movable dam type and shall be constructed in such a way that a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer. Sewer cleaning balls or other such equipment which cannot be collapsed instantly will not be considered acceptable cleaning equipment. The moveable dam shall be of the same diameter as the pipe being cleaned and shall provide a flexible scraper around the outer periphery to insure total removal of grease. If a line segment is

found to be completely stopped up, plugged, or heavily intruded with roots, then a mechanical root cutter shall be used.

- C. High velocity hydro-cleaning equipment shall be truck mounted for ease of operation. The equipment shall have a minimum of 600 feet of 1 inch I.D. high pressure hose with a selection of two or more high velocity nozzles. The nozzles shall have a capacity of 60 GPM at a minimum working pressure of 1000 pounds per square inch (psi). The nozzles shall be capable of producing a scouring action from 15 degrees to 45 degrees in all size lines designated to be cleaned. Equipment shall also have a high velocity gun for washing and scouring manhole walls and floor. The equipment shall carry its own water tank capable of holding corrosive or caustic cleaning or sanitizing chemicals, auxiliary engines, pump and a hydraulically driven hose reel. All controls shall be located so that equipment can be operated above ground with minimal interference to traffic and/or danger to the operator.
- D. Mechanical cleaning equipment shall be used to remove heavy accumulations of silt, sludge, roots, etc. Bucket machines shall be operated in pairs with each machine powered by an engine with a minimum of 16 horsepower (HP) to insure sufficient pulling power. Machines shall be capable of operating at least two speeds to match job conditions. Sufficient accessories and tools shall be furnished to accomplish the required cleaning in a complete and efficient manner.
- E. Power rodding machines shall be of a continuous rod type, capable of holding a minimum of 1000 feet of rod. The rod shall be specifically treated steel. The machine shall have a positive rod drive and produce a 2000 pound rod pull. To insure safe operation, the machine shall have a fully enclosed body and an automatic safety throw-out clutch.
- F. Cleaning equipment shall be provided that includes an air conveying vacuum system to provide for the simultaneous removal of the debris flushed to the manhole.
- G. A temporary debris catcher or similar device, as approved by the Engineer, shall be used in the downstream manhole to ensure that no debris is released into the downstream sections of the system.

2.02 PERSONNEL

- A. Contractor personnel shall be thoroughly familiar with all phases of sewer line cleaning to insure satisfactory end results without causing damage to the sewer lines or adjacent property.

PART 3 – EXECUTION

3.01 CLEANING EQUIPMENT

- A. The equipment selected for cleaning shall be capable of removing all dirt, grass, rocks, and other deleterious materials from the sewer lines and manholes. Contractor shall remove all grease accumulations.
- B. The Contractor shall make an inspection of the lines to be cleaned in order to determine the type of cleaning equipment that is required. It is anticipated that hydraulic cleaning will be adequate for most of the line segments.

3.02 CLEANING REQUIREMENTS

Prior to inspection, all sewer mains will be thoroughly cleaned as specified below:

- A. The sewer lines shall be cleaned by using standard mechanically powered or hydraulically propelled cleaning tools or combinations thereof, such as rodding machines, boring machines, hydraulic balls, cones, ferrets, or other similar devices.
- B. All roots, sludge, dirt, sand, rock, grease, and other solid or semi-solid material resulting from the cleaning operations shall be removed at the downstream manhole without passing the material to existing sewer mains. When cleaning equipment is used, a debris catch riser, as approved by Engineer, shall be used in the downstream manhole so that both solids and water shall be trapped. All solids or semi-solids resulting from the cleaning operations shall be removed from the site and disposed of by the Contractor. It is the responsibility of the Contractor to secure a legal dump site for the disposal of this material. Contractor will be responsible for any material allowed to enter sanitary sewer system as a result of this cleaning process. Contractor will be responsible for any damages resulting, either private or public, from any material entering the sanitary sewer system. All costs incurred to remove such material will be paid by the Contractor.

- C. Satisfactory precautions shall be taken to protect the sewer lines from damage that might be inflicted by the improper use of cleaning equipment. Whenever hydraulically propelled cleaning tools, which depend upon water pressure to provide their cleaning force or any tools which retard the flow of water in the sewer lines are used, precautions shall be taken to ensure that the water pressure created does not cause any damage or flooding to public or private property. Any damages resulting from improper use of cleaning equipment, either private or public, shall be the responsibility of the Contractor.
- D. When quantities of water from fire hydrants are necessary to avoid delay in normal working procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed or used when there is a fire in the area. Before using any water from the City water supply system, the Contractor shall apply for and receive permission from Owner. The Contractor shall be responsible for obtaining the water meter and coordinating any activities with the Owner. All charges for the set up and use of the water meter, including the water usage bill shall be the responsibility of the Contractor. All expenses shall be considered incidental to cleaning.
- E. **UNDER NO CIRCUMSTANCES SHALL SEWAGE OR SOLIDS REMOVED FROM THE SEWER SYSTEM BE DUMPED ONTO STREETS OR INTO DITCHES, CATCH BASINS, STORM DRAINS OR EXISTING SANITARY SEWER MANHOLES.**

33 05 23.15

UTILITY LINE BORES

1. GENERAL

1.01 WORK INCLUDED

- A. Provide encasement pipe jacked through bored tunnel for crossing of utility pipe lines under roadways where necessary.
- B. Pulling or jacking carrier pipe through encasement pipe.

1.02 RELATED WORK

- A. Excavating, Backfilling, and Compacting For Utility Pipelines
- B. Sanitary Sewer Pipelines, Water Lines, Etc.

1.03 REFERENCES

- A. AWWA C906
- B. PPI – Handbook of PE Pipe

1.04 Submittals

- A. Materials submittals shall include shop drawings for casing pipe showing sizes and connection details.
- B. End Seals
- C. Casing Spacers

2. PRODUCTS

2.01 MATERIALS

- A. Encasement pipe: Smooth wall HDPE pipe DR 9 DIPS, conforming to AWWA C906.
- B. Joints: Joints shall be made by butt fusion.
- C. Casing Spacers: HDPE Model CSP by CCI Pipeline Systems or approved equal.
- D. End Seals shall be GPT Link Seal or pre-approved equal. End seals shall be of EPPM (Black) with reinforced nylon pressure plates and bolts shall have a corrosion inhibiting coating. Carrier and Casing shall be clean and free of encumbrances prior to installation. Contractor shall submit the specific model and dimensional data for review.

2.02 MINIMUM DIMENSION RATIO

A. Minimum DR shall be DR9 for encasement sizes up through 20". DR 11 shall be used for encasement larger than 20". Only DIPS is allowed; with IPS prohibited.

3. EXECUTION

3.01 GENERAL INSTALLATION OF HDPE PIPE CASING BY BORING

Installation of HDPE pipe casing may be by the dry bore method. Installation of HDPE pipe casing shall be in accordance with the applicable regulation of the Arkansas Highway and Transportation Department, the Railroad, the Detail Drawings, these specifications, and any permits acquired with respect to the particular boring. All excavation for the pit and bore shall be unclassified.

3.02 INSTALLATION, ENCASEMENT AND CARRIER PIPE

- A. Highway Bore: Do not set up equipment or begin excavating pit on state highway without permission of Arkansas Highway and Transportation Department District Engineer or the authorized representative.
- B. Railroad Bore: Do not set up equipment or begin excavating pit on or near railroad property without permission of the respective railroad company.
- C. Boring Pit: The boring pit shall be solid sheeted, braced, and shored as necessary to provide a safe operation. The contractor shall take all precautions, and comply with all requirements as may be necessary to protect private or public property.
- D. Line and Grade: The Contractor shall set the boring rig so that after the casing is complete, and the water or sewer pipe is installed, the invert of the pipe shall conform to grade and alignment as shown on the Contract Drawings. As the casing is installed, Contractor shall check the horizontal and vertical alignment frequently. Contractor shall install the boring at a 90-degree angle to the crossing unless Owner approves a different crossing angle.
- E. Boring: Boring and jacking of the casing pipe shall be accomplished by the dry auger boring method without jetting, sluicing or wet boring. The hole

shall be bored and cased through the soil by cutting head on a continuous auger mounted inside the casing pipe. The boring of the hole and installation of the casing pipe shall be simultaneous. Lengths of the casing pipe shall be fully welded to the preceding section. Connect sections by full penetration butt welding performed in accordance with AWWA C906.

- F. Diameter of Hole: Bored installations shall have a bored hole diameter essentially the same as the outside diameter of the casing pipe to be installed.
- G. Casing Pipe Length: Lengths of casing pipe shall be as long as practical for site conditions. Joints between sections shall be completely butt welded in accordance with AWWA C906. Prior to welding joints, the Contractor shall ensure that both ends of the casing sections being welded are square.
- H. The contractor shall plan to use a casing lubricant, such as bentonite, in the event excessive frictional forces jeopardize the successful completion of the casing installation.
- I. Once the jacking procedure has begun, it should be continued without stopping until completed.
- J. Installation of the Carrier Pipe: The carrier pipe for the line shall be as shown on the Detail Sheet. Spacers for Installation of the carrier pipe shall be furnished and installed by the contractor.
- K. General: Joint pipe as specified in Sanitary Sewer Pipelines. Pull or jack carrier pipe through encasement pipe. Do not allow cables or jacks to be in direct contact with carrier pipe while pulling or jacking pipe. Use timber or padded HDPE member.

3.03 HDPE Casing by Horizontal Directional Drilling:

HDPE Casing pipe may be installed by the Directional Drilling Method in accordance with manufacturer's recommendations, ASTM F 1962 Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacle, Including River Crossings, Plastic Pipe Institute Polyethylene Pipe for Horizontal Directional Drilling.

- A. The movements of the pipe stings and the pulling load on the polyethylene pipe shall be monitored and a weak link device shall be used to ensure that the pipe is not damaged during installation
- B. Contractor shall allow a 24-hour relaxation period for pipe installed by directional drilling before fusing additional pipe to the pulled in pipe.
- C. Wet boring using pressurized water streams is prohibited.

3.04 HDPE Carrier Pipe by Horizontal Directional Drilling:

HDPE carrier pipe may be installed by the Directional Drilling Method in accordance with manufacturer's recommendations, ASTM F 1962 Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacle, Including River Crossings, Plastic Pipe Institute Polyethylene Pipe for Horizontal Directional Drilling.

- A. The movements of the pipe stings and the pulling load on the polyethylene pipe shall be monitored and a weak link device shall be used to ensure that the pipe is not damaged during installation
- B. Contractor shall allow a 24-hour relaxation period for pipe installed by directional drilling before fusing additional pipe to the pulled in pipe.
- C. Annular grout must be injected after pull-back. Injection during pull-back is prohibited. Submit on grout product for approval prior to use.

3.05 BACKFILL

- A. Prior to backfill, seal ends of encasement pipe with rubber casing end seals
- B. Use material excavated from pit.
- C. Backfill against ends of encasement pipe.
- D. Backfill pit and carrier pipe in same manner as specified in Sanitary Sewer Pipelines.

3.06 CLEANUP

- A. Clean up ground surface around work area in same manner as specified for line work in Excavation, Backfilling, and Compacting.

SECTION 33 1200

VALVES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install complete and ready for operation and test all valves as shown on the Drawings and as specified herein.
- B. The equipment shall include the following:
 - 1. Valve Actuators - General
 - 2. Plug Valves
 - 3. Air Release Valves

1.02 RELATED WORK

- A. Piping is included in the respective Sections of Division 40.
- B. Certain appurtenances for individual types of pipe or systems are specified with the specific type of pipe or system. However, additional items are specified in this Section.
- C. Certain items similar to those specified in this Section may be specified to be furnished and installed with individual equipment or systems. In case of a conflict, those individual equipment or system requirements shall govern.
- D. Valve operators of all types, rate of flow controllers (including modulating valves and operators) and other types of valves which are part of the automated instrumentation (such as some solenoid valves) if not included herein are included in Division 11. Valve operators shall, however, be mounted at the factory on the valves as specified herein, as part of the work of this Section.

1.03 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01 3000, materials required to establish compliance with this Section. Submittals shall include at least the following:
 - 1. Certified drawings showing all important details of construction and dimensions.
 - 2. Descriptive literature, bulletins and/or catalogs of the equipment.
 - 3. The total weight of each item.
 - 4. A complete bill of materials.
 - 5. Additional submittal data, where noted with individual pieces of equipment.
 - 6. Location of the valve and actuator manufacturing facility.

7. Electrical characteristics and wiring diagrams including but not limited to voltage, load in kW, Hp or FLA and phase.

B. Test Reports

1. Provide certified hydrostatic test data, per manufacturer's standard procedure or MSS-SP-61 for all valves.

C. Certificates

1. For each valve specified to be manufactured, tested and/or installed in accordance with AWWA and other standards, submit an affidavit of compliance with the appropriate standards, including certified results of required tests and certification of proper installation.

D. Manufacturer's Installation and Application Data

E. Operating and Maintenance Data

1. Operating and maintenance instructions shall be furnished to the Engineer as provided in Section 01 8823. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions and other information required to instruct operating and maintenance personnel unfamiliar with such equipment.

F. Manufacturer's Warranty

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
2. ASTM A536 - Standard Specification for Ductile Iron Castings.
3. ASTM B30 - Standard Specification for Copper Alloys in Ingot Form.

B. American Water Works Association (AWWA)

1. AWWA C504 - Rubber-Seated Butterfly Valves
2. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service
3. AWWA C540 - Power-Actuating Devices for Valves and Slide Gates
4. AWWA C550 - Protective Interior Coatings for Valves and Hydrants

C. American National Standards Institute (ANSI)

1. ANSI B2.1 - Specifications, Dimensions, Gauging for Taper and Straight Pipe Threads (except dry seals).

2. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings
3. ANSI B16.10 - Face-to-Face and End-to-End Dimensions of Valves
4. ANSI B16.104 - Butterfly Valves

D. American Iron and Steel Institute (AISI)

E. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)

1. MSS-SP-61 - Pressure Testing of Steel Valves.
2. MSS-SP-67 - Butterfly Valves.
3. MSS-SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
4. MSS-SP-71 - Cast Iron Swing Check Valves, Flanges and Threaded Ends.
5. MSS-SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Services.
6. MSS-SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
7. MSS-SP-80 - Bronze Gate, Globe, Angle and Check Valves.
8. MSS-SP-82 - Valve Pressure Testing Methods
9. MSS-SP-98 - Protective Coatings for the Interior of Valves, Hydrants and Fittings.

F. National Electrical Manufacturers Association (NEMA)

G. Underwriters Laboratories (UL)

H. Factory Mutual (FM)

- I. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Qualifications

1. Valves and appurtenances shall be products of well established firms who are fully experienced, minimum 10 years, reputable and qualified in the manufacture of the particular equipment to be furnished. Bonds in lieu of experience will not be acceptable.
2. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with this Section as applicable.
3. All units of the same type shall be the product of one manufacturer.

B. Certifications

1. The manufacturers shall furnish an affidavit of compliance with Standards referred to herein as specified in Paragraph 1.03C above. Refer to PART 3 for testing required for certain items in addition to that required by referenced standards.

- C. Inspection of the units may be made by the Engineer or other representative of the Owner after delivery. The equipment shall be subject to rejection at any due to failure to meet any of the specified requirements, even though submittal data may have been accepted previously. Equipment rejected after delivery shall be marked for identification and shall be removed from the job site at once.

1.06 SYSTEM DESCRIPTION

- A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of water and air as noted on the Drawings.
- B. Valves, appurtenances and miscellaneous items shall be installed as shown on the Drawings and as specified, so as to form complete workable systems.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Reference is made to Section 01 6610 for additional information.

B. Packing and Shipping

1. Care shall be taken in loading, transporting and unloading to prevent injury to the valves, appurtenances, or coatings. Equipment shall not be dropped. All valves and appurtenances shall be examined before installation and no piece shall be installed which is found to be defective. Any damage to the coatings shall be repaired as acceptable to the Engineer.
2. Prior to shipping, the ends of all valves shall be acceptably covered to prevent entry of foreign material. Covers shall remain in place until after installation and connecting piping is completed.
 - a. All valves 3-in and larger shall be shipped and stored on site until time of use with wood, plywood, or plastic covers on each valve end.
 - b. Valves smaller than 3-in shall be shipped and stored as above except that heavy cardboard covers may be used on the openings.
 - c. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until the valve is installed and put into use.
 - d. Any corrosion in evidence at the time of acceptance by the Owner shall be removed, or the valve shall be removed and replaced at no cost to the Owner.

C. Storage and Protection

1. Special care shall be taken to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, to prevent deformation. See the individual piping sections and manufacturer's information for further requirements.

1.08 MAINTENANCE

- A. Special tools including packing maintenance hardware and the manufacturer's standard spare parts, if required for normal operation and maintenance, shall be supplied with the equipment in accordance with Sections 01 8823 and where noted, as specified herein.
- B. Provide all special tools required for normal maintenance. Tools shall be packaged in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended.
- C. Provide to the Owner a list of all spare and replacement parts with individual prices and location where they are available. Prices shall remain in effect for a period of not less than 1 year after start-up and final acceptance.

1.09 WARRANTY

- A. The Contractor shall obtain from each valve and actuator manufacturer its warranty that the equipment shall be warranted for a period of 1 year from the date of Substantial Completion, as defined in the General Conditions, Division 0 and specified in Section 01 7836, to be free from defects in workmanship, design or material. If the equipment should fail during the warranty period due to a defective part(s), the part(s) shall be replaced in the equipment and the unit(s) restored to service at no expense to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT - GENERAL

- A. Reference is made to Division 1 for additional requirements, including nameplates, provisions for temporary pressure gauges, protection against electrolysis and anchor bolts.
- B. The use of a manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- C. Valves and appurtenances shall be of the size shown on the Drawings or as noted and as far as possible equipment of the same type shall be identical and from one manufacturer.
- D. Valves and appurtenances shall have the name of the maker, nominal size, flow directional arrows, working pressure for which they are designed and standard referenced, cast in raised letters or indelibly marked upon some appropriate part of the body.
- E. Unless otherwise noted, items shall have a minimum working pressure of 250 psi or be of the same working pressure as the pipe they connect to, whichever is higher and suitable for the pressures noted where they are installed.
- F. Joints, size and material - unless otherwise noted or required by the Engineer:
 - 1. Except where noted, all joints referred to herein shall be of the same type, nominal diameter, material and with a minimum rating equal to the pipe or fittings they are connected to.
 - 2. Valves and appurtenances shall be of the same nominal diameter as the pipe or fittings they are connected to unless otherwise specified.

3. All valves exposed to view, or in vaults.
 - a. 2-1/2-in and smaller - threaded or soldered ends as required.
 - b. 3-in - threaded or flanged as shown.
 - c. 4-in and larger flanged ends.
- G. Provide all special adaptors as required to ensure compatibility between valves, appurtenances and adjacent pipe.
- H. Valves and actuators located outdoors but not within a building; within maximum 2-ft above liquid; in vaults; or where otherwise noted shall be designed for submerged service where water may completely submerge the valve and operator. All other units shall have NEMA 4X enclosures. Valves and actuators to be installed within valve vaults in yard and designed for submerged service shall have Type 316 stainless steel bolts and hardware.

2.02 VALVE ACTUATORS - GENERAL

- A. See the Paragraph 2.01H above for submergence requirements.
- B. The valve manufacturer shall supply, mount and test all actuators on valves at the factory. The valves and their individual actuators shall be shipped as a unit.
- C. All actuators shall be capable of moving the valve from the full open to full close position and in reverse and holding the valve at any position part way between full open or closed.
- D. Each operating device shall have cast on it the word "OPEN" and an arrow indicating the direction of operation.
- E. Floor boxes for operating nuts recessed in concrete shall be standard cast iron type, cast-in-place, with fastening top by Clow or equal.
- F. Stem guides shall be of the adjustable wall bracket type, bronze bushed, with maximum spacing of 10-ft as manufactured by Clow; Rodney Hunt or equal. Extended operating nuts and/or stems shall have universal joints and pin couplings, if longer than 10-ft and a rating of at least five times the maximum operating torque. Stem adaptors shall be provided.
- G. Where required by the installation, or as specified, provide the following: extended stem; floor stand and handwheel; position indicator and etched or cast arrow to show direction of rotation to open the valve; resilient, moisture-resistant seal around stem penetration of slab.
- H. Additional valve actuator requirements are included with the individual valve types and as noted in Paragraph 1.02 above.
- I. All position indication and direction of opening arrows shall be embossed, stamped, engraved, etched or raised castings. Decals or painted indications shall not be allowed.
- J. Unless otherwise noted, all valves larger than 3-in nominal diameter shall be provided with position indicators at the point of operation.

2.03 PLUG VALVES

- A. All plug valves shall be Model PEF 100% Port Eccentric Plug Valves as manufactured by DeZURIK or approved equal.
- B. Valve order code shall be PEF,6,MJ,CI,NBR,CR*NT

2.04 COMBINATION AIR VALVES

- A. The combination air valves shall be the 2" Model D-26 reinforced nylon body valve as manufactured by A.R.I. Flow Control Accessories, LTD.
- B. All buried valves for the forcemain shall be provided as the D-26 SB complete product package with 4" flanged inlet.

2.05 VALVE ACTUATORS

- A. The valve manufacturer shall supply, mount and test actuators on valves at the factory. The valves and their individual actuators shall be shipped as a unit.
- B. Unless otherwise noted on the Drawings, valves shall be manually actuated. Buried and exposed valves with operating nuts shall have a non-rising stem with an AWWA 2-in nut; At least two tee handles shall be provided for each different size operating nut. Unless otherwise noted, operation for valves shall be counterclockwise open. Where shown on the drawings exposed valves shall be supplied with geared actuators and handwheels.
- C. Actuators shall be capable of moving the valve from the full open to full close position and in reverse and holding the valve at any position part way between full open or closed.
- D. Each operating device shall have cast on it the word "OPEN" and an arrow indicating the direction of operation.

2.06 SURFACE PREPARATION AND SHOP COATINGS

- A. Notwithstanding any of the specified requirements, all coatings and lubricants in contact with potable water shall be certified as acceptable for use with that fluid.
- B. If the manufacturer's requirement is not to require finished coating on any interior surfaces, then manufacturer shall so state and no interior finish coating will be required, if acceptable to the Engineer.
- C. The exterior surface of various parts of valves, operators, floor-stands and miscellaneous piping shall be thoroughly cleaned of all scale, dirt, grease or other foreign matter and thereafter one shop coat of an approved rust-inhibitive primer shall be applied in accordance with the instructions of the paint manufacturer. Primer shall be compatible with the finish coat provided.
- D. Unless otherwise noted, interior ferrous surfaces of all valves shall be given a shop finish of an AWWA C550 approved epoxy with a minimum thickness of 4 mil.

- E. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating. Mounting surfaces shall be especially coated with a rust preventative.
- F. Special care shall be taken to protect uncoated items and plastic items, especially from environmental damage.

2.07 FACTORY INSPECTION, TESTING AND CORRECTION OF DEFICIENCIES

- A. Factory inspection, testing and correction of deficiencies shall be done in accordance with the referenced standards and as noted herein.
- B. See Division 1 for additional requirements. Also refer to PART 1, especially for required submission of test data to the Engineer.
- C. In addition to all tests required by the referenced standards, the following shall also be factory tested:
 - 1. Pressure regulating valves shall be factory tested at the specified pressures and flows.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. All valves and appurtenances shall be installed per the manufacturer's instructions in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.
- B. Install all brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings, or otherwise required. Before setting these items, check all Drawings and figures which have a direct bearing on their location. The Contractor shall be responsible for the proper location of valves and appurtenances during the construction of the work.
- C. All materials shall be carefully inspected for defects in construction and materials. All debris and foreign material shall be cleaned out of openings, etc. All valve flange covers shall remain in place until connected piping is in place. All operating mechanisms shall be operated to check their proper functioning and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the Owner.
- D. Where installation is covered by a referenced standard, installation shall be in accordance with that standard, except as herein modified, and the Contractor shall certify such. Also note additional requirements in other parts of this Section.
- E. Unless otherwise noted, joints for valves and appurtenances shall be made up utilizing the same procedures as specified under the applicable type connecting pipe joint and all valves and other items shall be installed in the proper position as recommended by the manufacturer. Contractor shall be responsible for verifying manufacturers' torquing requirements for all valves.

3.02 INSTALLATION OF MANUAL OPERATIONAL DEVICES

- A. Unless otherwise noted, all operational devices shall be installed with the units of the factory, as shown on the Drawings or as acceptable to the Engineer to allow accessibility to operate and maintain the item and to prevent interference with other piping, valves and appurtenances.
- B. For manually operated valves 3-in in diameter and smaller, valve operators and indicators shall be rotated to display toward normal operation locations.
- C. Floor boxes, valve boxes, extension stems and low floor stands shall be installed vertically centered over the operating nut, with couplings as required and the elevation of the box top shall be adjusted to conform with the elevation of the finished floor surface or grade at the completion of the Contract. Boxes and stem guides shall be adequately supported during concrete pouring to maintain vertical alignment.

3.03 INSPECTION, TESTING AND CORRECTION OF DEFICIENCIES

- A. See also Division 1. Take care not to over pressure valves or appurtenances during pipe testing. If any unit proves to be defective, it shall be replaced or repaired to the satisfaction of the Engineer.
- B. No testing shall be performed until the manufacturer's service engineer has provided written certification that the following installed equipment has been examined and found to be in complete accordance with the manufacturer's requirements:
 - 1. All motorized valves.
 - 2. All pressure regulating valves.
 - 3. Combination sewage air valve.
- C. Functional Test: Prior to startup, all items shall be inspected for proper alignment, quiet operation, proper connection and satisfactory performance. All motorized units shall be operated through 20 complete cycles, without vibration, jamming, leakage, or overheating and perform the specified function. All manual actuators shall be operated through ten complete cycles.
- D. The various pipelines in which the valves and appurtenances are to be installed are specified to be field tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the Engineer.
- E. Various regulating valves, strainers, or other appurtenances shall be tested to demonstrate their conformance with the specified operational capabilities and any deficiencies shall be corrected or the device replaced or otherwise made acceptable to the Engineer.

3.04 CLEANING

- A. All items (including valve interiors) shall be cleaned prior to installation, testing and final acceptance.

END OF SECTION

33 31 00

SANITARY SEWER PIPELINES & FITTINGS

1. GENERAL

1.01 WORK INCLUDED

- A. Installation, manufacture, transportation, and storage of pipe, pipe joints, and fittings for sanitary sewer pipelines and service lines.
- B. Point repairs on existing sanitary sewer pipelines.
- C. Use only pipe, fittings, and adapters described in these specifications or approved by the Engineer.
- D. Use bends, tees, plugs, wyes, or other approved fittings constructed from the same material as the pipe in which they are installed, when possible. Use only standard, approved fittings.

1.02 DEFINITIONS

- A. New Pipelines - Pipelines installed in such a manner that there is no sewage flow during construction.
- B. Replacement Pipelines - Pipelines installed in a trench while there is a flow from "live" service connections.
- C. Point Repairs - Replacement of a short section (less than 50 feet in length) in an existing pipeline.
- D. Force Mains - Sewer pipelines that transport wastewater under pressure from a pump station to a discharge point.
- E. City Sewer Main - A public sanitary sewer in which all owners of abutting properties have equal rights and is maintained and controlled by the Owner. No sewer line smaller than six (6) inches in diameter is a city sewer.
- F. Service Line - The sewer which conveys the discharge from a building's plumbing system or other approved waste system to the city sanitary sewer system.

1.03 SUBMITTALS

- A. Submit to the Engineer all materials and procedures not described in these specifications. Approval from Engineer is required prior to installation of any materials not described in these specifications.
- B. Pipe Type, Size, Dimensions, and Classification.
- C. Wyes for service connections
- D. Reinforced Couplings
- E. Service Saddles

1.04 SPECIAL REQUIREMENTS CONCERNING FIELD LOCATION OF PIPE, BENDS, CLEANOUTS, AND MANHOLES ON SERVICE LINES

- A. Bends
 - 1. Avoid using short radius ninety degree bends on 4" service lines.
 - 2. Use only long sweep bends where bends are absolutely necessary.
- B. Cleanouts
 - 1. Cleanouts are required at the building foundation.
 - 2. On lines longer than one hundred (100) feet, cleanouts are required at one hundred (100) foot spacing.
 - 3. Install cleanouts adjacent to any ninety degree bend.
 - 4. Install pipe on cleanout riser up to finish grade.
 - 5. The cleanout shall be the same diameter as the pipe on which it is installed.
- C. Backwater Traps (Sewage check valve)
 - 1. Provide backwater traps as required of the Arkansas Plumbing Code or as shown on the plans.
 - 2. Backwater Traps shall be Mainline "Adapt-A-Valve" or approved equal.

1.05 PROTECTION

- A. In all cases the Contractor is responsible for protecting public and private property and protecting any person or persons who might be injured as a result of the Contractor's work.

- B. All utilities shown on the plans may not represent the exact location; however, the contractor is responsible for verifying these locations and contacting "Arkansas One Call System" before excavating.

2. PRODUCTS

2.01 PROHIBITED PIPE MATERIALS

- A. The following materials are specifically forbidden for use either in city sewers or service lines:
 - 1. Asphalt impregnated fiber tube pipe.
 - 2. Concrete pipe.
 - 3. Open profile PVC pipe as defined in ASTM F794 less than 24" in diameter.
 - 4. "No Hub" cast iron soil pipe or other non bell and spigot pipe.
 - 5. Corrugated Metal Pipe

2.02 SERVICE LINES

- A. Service lines are typically four (4) inches in diameter, but shall include all private service connections to the main. Six (6) inch service lines shall be as 4" Service Lines. The diameter of the wye branch and/or service saddle shall be the same diameter of existing service line. No reducers are allowed.
- B. Furnish one of the following:
 - 1. Polyvinyl chloride (PVC) pipe for service lines being relayed shall be SCH 40 and shall be bedded as required for PVC pipe.
 - 2. Certa-Lok SDR 21 pipe shall be used for service lines being pipe burst.

2.03 DUCTILE IRON PIPE FOR GRAVITY MAINS

- A. Minimum wall thickness: Thickness Class 50 or 51 according to ANSI/AWWA-C150/A 21.50: Thickness Design of Ductile Iron Pipe or Pressure Class 350, if approved by Engineer.
- B. Gravity Sanitary Sewer ASTM A 746: Ductile Iron Pipe Gravity Sewer Pipe
- C. Cement lining (Double Thickness): ANSI/AWWA C 104/A 21.4: Cement Mortar Lining for Gray and Ductile Iron Pipe.
- D. Joint connections, pipe, and fittings:

1. Push on and mechanical rubber gasket joints: ANSI/AWWA C111/A21.11.
 2. Flanged: ANSI/AWWA C115/A21.15, ANSI B16.1.
 3. Grooved and shouldered ANSI/AWWA C606.
- E. Corrosion Control
1. Polyethylene wrap in tube or sheet form conforming to the requirements of ANSI/AWWA C105/A21.5.

2.04 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE (Solid Wall)

- A. Pipe eight (8) inches in diameter and larger: conform to ASTM D 3034 and D 3915. Minimum standard dimension ratio (SDR) shall be twenty-six (SDR 26).
- B. Joint connections: push on, elastomeric gasket type conforming to ASTM D 3212.

**2.05 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE REPAIR
COUPLINGS**

- A. Use PVC repair couplings instead of flexible rubber coupling when connecting two PVC pipes.
- B. Install repair couplings in accordance with manufacturer's recommendations.

2.09 REINFORCED COUPLINGS

- A. Materials: Chemical resistant rubber. Reinforced Adjustable Repair Couplings shall be MAXADAPTOR or prior approved equal.
- B. Coupling shall be made of stainless steel utilizing a nut and bolt clamp design and an "O" ring seal under the sealing clamp band.
- C. Dimensions: Inside diameter to fit the outside diameter of the different pipe materials being connected: take care that proper alignment is maintained and the spacing between pipes does not exceed 1/2 inch.
- D. Any other Coupling other than specified above must be approved by the Engineer prior to use.

2.10 SERVICE SADDLES

- A. A composite saddle using a Virgin SBR compound gasket (ASTM D-2000 3 MBA 710) and a ductile iron saddle casting (ASTM 536 Grade 65-45-12) as shown in the Standard Details. Romac Saddle or Pre-approved equal.
- B. A compression fit three piece service connection consisting of an ASTM D-3034 PVC hub, a Stainless Steel band (301SS), and a rubber sleeve conforming to ASTM F-477. Refer to the Standard Details. Insert a TEE or pre-approved equal.
- C. An injection molded gasketed SDR26 sanitary sewer fitting, ASTM D3034, ASTM F1336 and CSA B182.2 The injection molded from virgin PVC compound having a cell classification at 12454 or 13343 ASTM D1784. Gasket conforming to ASTM F477. The fitting shall be sized for the diameter of the main sewer pipe. No 8" fitting for 10" pipe will be allowed, for example.
- D. All saddles other than those shown above shall be pre-approved by the Engineer prior to bidding.
- E. All service saddle connections shall be cored or drilled by a circular or mechanical coring machine per manufacturer

2.11 SERVICE WYES

- A. The wye material and joint type must match that of the mainline pipe.
- B. Wyes shall terminate in a bell suitable for connection of a 4-inch service line pipe as specified herein for new construction.

3. EXECUTION

3.01 EXCAVATION - GENERAL

- A. Perform excavation and prepare bedding accordingly.
- B. Never lay pipe in a water-filled trench, or when trench conditions or weather are unsuitable for such Work.
- C. Divert surface water and de-water trenches during excavation.
- D. Excavate for bells so that the entire barrel of the pipe will be uniformly supported on the pipe bedding before placing pipe in the trench.

3.02 LAYOUT

- A. The Contractor shall install sewer lines, wyes, and manholes as shown on the Plans.

3.03 SHALLOW BURY

- A. Ductile iron pipe shall be required when the existing grade or the proposed finish grade, whichever is less, provides less than 30 inches of cover. The ductile iron pipe shall, whenever feasible, extend from manhole to manhole. The ductile iron pipe shall meet all the requirements.

3.04 PIERS

- A. Install concrete piers as indicated on the plans.

3.05 STEEP GRADES

- A. Whenever the grade of the sewer line exceeds 15 percent, ductile iron pipe shall be required. The ductile iron pipe shall meet the requirements of this section.
- B. Sewers on 20 percent slopes or greater shall be anchored securely with concrete anchors spaced as follows:
 - 1. Not over 36 feet center to center on grades 20 percent and up to 35 percent.
 - 2. Not over 24 feet center to center on grades 35 percent and up to 50 percent.
 - 3. Not over 16 feet center to center on grades 50 percent and over.
- C. Anchor collars should be placed on downstream side of bell. Where no bell is available, a retainer gland shall be installed.

3.06 PIPE INSTALLATION

- A. Inspect each joint of pipe carefully before it is placed in the trench. Plainly mark and separate from the remaining pipe any joint found to be cracked, warped, or otherwise damaged. Remove these damaged joints from the project site immediately.
- B. Cut pipe in a neat and workmanlike manner without damage to pipe or pipe lining when trimming joint length.
- C. Lay all pipes with the bells upstream.

- D. Use proper equipment for lowering sections of pipe into trenches. Lower pipe carefully into the trench so the spigot and bell does not become contaminated.
- E. Lay each pipe joint to line and grade using laser beam grade light, keeping a minimum of six inches between the pipe and the trench wall.
- F. Close the open ends of the pipeline temporarily with an appropriate manufactured plug at the end of each day's Work or when discontinuing pipe laying for an appreciable period of time.
- G. Lay service lines on a straight alignment and at a constant slope. Install pipe a minimum slope of one percent (1.00%); this equals one-eighth inch fall per lineal foot (1/8" / LF). The maximum allowable deflection in a horizontal plane is one inch per lineal foot (1.00"/LF).
- H. Install bends on 4" service lines at all changes in alignment and slope. Cleanouts are required at 90 degree bends and every 100 feet on lines longer than 100 feet. Bends on 6" and larger service lines are only permitted within 5 feet of the building foundation and 2 feet from the manhole being connected to; if longer than 150 feet, bends are not allowed and manholes must be built.
- I. Keep the interior of pipe joints clean from all dirt and other foreign matter as the work progresses. Maintain the pipe's interior cleanliness until accepted or put in service.
- J. At the end of each day's work, and when for any reason the laying of pipe will be discontinued for an appreciable period, close the open ends of the pipeline temporarily with an appropriate manufactured plug.

3.07 PIPE TO PIPE CONNECTIONS

- A. Make all pipe joints in strict accordance with the manufacturer's recommendation and as stated below for the particular type of connection. Make all joints watertight in accordance with the latest ASTM Standards.
- B. "No-Hub" type pipe connections are not permitted.
- C. Slip-type or Push-on Joints Connection Procedure

1. Clean the bell and spigot end of the pipes prior to jointing thoroughly with a brush. Exercise particular care to clean the gasket seat.
2. Apply pipe lubricant and attach gasket in strict accordance with the specific joint manufacturer's recommendations. Clean and insert the rubber gasket in the gasket seat within the bell. Insert the spigot end of the upstream pipe in the bell of the downstream pipe. Push the upstream joint until it is in firm contact with the shoulder of the bell.

D. Mechanical Joints Connection Procedure

1. Clean thoroughly the spigot end of the pipe, the bell of the connecting pipe, and the rubber gasket as specified for slip-type or push-on joints. Clean the gland in a similar manner.
2. After the gland and gasket are placed on the spigot end of the pipe, a sufficient distance from the end to avoid fouling the bell, insert the spigot end in the fitting bell to the point of firm contact with the bell shoulder. Then advance the rubber gasket into the bell and seat in the gasket seat. Exercise care to center the spigot end within the bell. Bring the gland into contact with the gasket, enter all bolts, and make all nuts hand tight. Exercise continued care to keep the spigot centered in the bell.
3. Bring the gland into contact with the gasket, enter all bolts, and make all nuts hand tight. Exercise continued care to keep the spigot centered in the bell.
4. Make the joints tight by turning the nuts with a torque wrench: First partially tightening a nut, then partially tightening the nut 180 degrees away from it. Work around the pipe with uniformly applied tension until the required torque is applied to all nuts. Required torque ranges and indicated wrench lengths for standard cast iron bolts are as follows:

Diameter	Range of Torque		Length of Wrench
	<u>Foot</u>	<u>Pounds</u>	<u>Inches</u>
5/8	40 – 60		8

3/4	60 – 90	10
1	70 – 100	12
1-1/4	90 – 120	14

E. Reinforced Rubber Couplings

1. Install reinforced rubber coupling only where dissimilar pipe materials are connected.
2. Take care that proper alignment is maintained and a maximum spacing between pipes does not exceed one-half inch.
3. Encase rubber coupling in Class B concrete as shown on the Standard Details.

3.08 WYE FITTINGS FOR SERVICE CONNECTIONS

- A. The wye material and joint type must match that of the mainline pipe. No TEEs are allowed.
- B. Install wye branches at the location of live services or as indicated on the construction plans. Install wye connections for services in accordance with the manufacturer's recommendations.
- C. Place Class "B" concrete under each wye branch to prevent cracking or twisting under earth loads.
- D. Mark wyes for future connections using detectable tape or ski rope terminated at the ground surface. Install on each service wye either:
 1. A service stub terminated with a plugged bell; or,
 2. A plugged adapter capable of connecting to a four-inch cast iron service.
- E. Terminate wyes for future connections in a bell suitable for connection of a four-inch service line pipe as specified herein. Securely plug all wyes and service stubs for future connections.
- F. Manhole Taps
 1. Make manhole tap connections into existing manholes as indicated on the plans.

2. Install manhole taps no more than twenty-four (24) inches or $2/3$ of the main line pipe diameter whichever is greater above the manhole invert.
3. Make manhole tap watertight and flush with inside surface of manhole.
4. Manhole taps are considered as part of the service line and are subject to inspection.

3.09 BACKFILLING AND INSPECTION

- A. Before backfilling, place concrete encasement at transitions between different types of pipe and around all reinforced rubber couplings. Use Class B concrete.
- B. Install backwater traps (Sewage check valve) if required.
- C. Before backfilling, install concrete anchor collars in accordance with the details at the location and interval and shown on the Plans. Use Class A concrete and reinforce with steel bars.
- D. After the pipeline is installed and visually inspected by the Engineer or Engineer's Representative, backfill the trench accordingly
- E. Test the pipeline accordingly.
- F. Repair all concrete, pavement, and gravel surfacing.
- G. Repair all incidental damage to buildings, structures, utilities, pavements, landscaping, etc.
- H. Repair sodded and grass areas to original condition.
- I. Gravel shall be delivered to the line segment and/or open trench where construction is occurring. No hauling of gravel with backhoe or loader from stockpile is allowed. Gravel shall be dumped at the site of backfilling. Hauling at gravel is to be by dump truck only.

3.10 CONNECTION OF NEW SEWER PIPELINES TO EXISTING SANITARY SEWERS

- A. Construct, clean, test, and obtain Owner's approval before connecting new pipeline to the existing sewer.

- B. Connection of new sewer pipelines to existing sanitary sewers cannot be made until the entire project is ready for final acceptance by the Owner/Engineer.
- C. All new pipelines must connect to the existing system at a new or existing manhole. If a new manhole is built over an existing sewer line, the line segment shall be segregated for casting of MH bench and invert.
- D. If a new pipeline is to discharge into an existing manhole, divert the sewage flow around the existing manhole while the tie-in is under construction. Intercept the sewage flow at the existing manhole first upstream from the tie-in construction. Provide suitable pumping equipment and re-routing conduit to pump the sewage around the tie-in construction. Discharge into an appropriate manhole downstream from the construction.
- E. Connect new pipelines to existing manholes in a neat, workmanlike manner, to ensure a watertight connection.

3.11 GRAVITY SEWER PIPELINE INSTALLATION – LIVE SEWER PIPELINES AND POINT REPAIRS

- A. Install sewer pipeline and point repairs as detailed above for new pipelines with the following exceptions:
 - 1. Divert all upstream flow around the section to be replaced with plugs or pumps. The bedding must be kept dry during installation. If trench bottom is too wet, excavate wet portion and replace with suitable bedding material.
 - 2. Make transitions to original pipe using materials and procedures specified. Take care that replacement pipe is aligned properly with no offsets. Install concrete encasement around transitions. Take care that no concrete from the encasement enters the existing pipeline. If this occurs, remove the concrete.
 - 3. At the end of each day's work, and when for any reason the laying of pipe will be discontinued for an appreciable period, place a temporary section of pipe in the live line.

4. Pressure testing is not required. Visual and television testing are required.
5. Mandrel testing may be required.
6. Service line pressure testing is not required.
7. All construction debris must be collected and kept from entering sewer system.

3.12 GRAVITY SEWER PIPELINE INSTALLATION - AERIAL CROSSINGS

- A. Construct piers as shown on Plans.
- B. Install pipe on piers to grade.

3.13 FORCE MAIN PIPELINE INSTALLATION

- A. Install all pipe and fittings to the line and grade as detailed on the Plans. Submit fitting substitution requests to the Engineer for approval.
- B. Remove all dirt and other foreign matter from the inside of pipe and fittings before they are lowered into the trench. Keep pipe and fittings clean during and after laying. Take care to keep dirt out of the bells. Plug all pipe openings at the end of each days work or when pipe laying is discontinued.
- C. Use proper equipment for lowering sections of pipe into trenches. Lower pipe carefully into the trench so the spigot and bell does not become contaminated.
- D. Cut pipe in a neat and workmanlike manner without damage to pipe or pipe lining when trimming joint length.
- E. Install pipe with bell ends facing in the direction of laying. Face bells upgrade on lines on an appreciable slope.
- F. When necessary to deflect pipe from a straight line in either the horizontal or vertical plane to avoid obstructions, do not deflect the pipe beyond the point recommended by the pipe manufacturer.
- G. Before backfilling, install concrete thrust blocking in accordance with Standard Details on Plans.
- H. Test the pipeline per Inspection and Testing of Sanitary Sewer Pipelines, Manholes, and Service Lines.
- I. Install all flushing stations, check valves, air and vacuum release valves, and all necessary fittings according to manufacturers' recommendations.
- J. After the pipeline is installed, tested, and visually inspected by the Engineer, backfill the trench per Excavation, Backfilling, and Compacting. Repair all concrete, asphalt, and gravel surfacing. Repair all incidental damage to buildings, structures, utilities, pavements, landscaping, etc.

K. Repair sodded and grass areas to original condition.

3.14 PIPE BURSTING SERVICE LINES

- A. Pipe bursting of existing service lines shall be done only with prior approval from Engineer. Submittal of location, depth, method used, pipe material to be installed, and reason for bursting service line instead of conventional relay will be required prior to approval.
- B. Pre-and Post televising of existing service line will be required.
- C. Connections at each end of pipe bursting shall be inspected by RPR.

33 34 00

PVC PRESSURE PIPE

1. GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install and test all polyvinyl chloride (PVC) piping, fittings and appurtenances as shown on the Drawings and specified herein.
- B. General Design: The equipment and materials specified herein are intended to be standard types of PVC pipe and ductile iron fittings for use in transporting potable water, and Wastewater and sludge under pressure.

1.02 QUALITY ASSURANCE

- A. Qualifications: All of the PVC pipe and ductile iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed, installed in accordance with the best practices and methods and shall comply with these specifications as applicable.
- B. Standards:
 - 1. AWWA C900/C905
 - 2. NSF 14
 - 3. UNI-B-1 through 5
- C. Factory Tests: The manufacturer shall perform the factory tests described in Section 3 - AWWA C900/C905.
- D. Quality Control:
 - 1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards.
 - 2. In addition to the manufacturer's quality control procedures, the UTILITY may select an independent testing laboratory to inspect the material at the production facility for compliance with these specifications. The UTILITY will pay for the cost of facility inspection requested by the UTILITY.

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted for review and acceptance prior to construction in accordance with the General Conditions and specifications.
- B. Materials and Shop Drawings
- C. Manufacturer's Certification
 - 1. Submit sworn certification of factory tests and their results.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer's recommendations. PVC pipe shall be covered with black plastic with a minimum thickness of 15-mil. Joint gaskets shall be stored in a clean, dark and dry location until use.
- B. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe or fittings and their respective coatings. Pipe or fittings shall not be rolled off the carrier or dropped. Pipe shall be unloaded by lifting with a forklift or crane. All pipe or fittings shall be examined before installation and no piece shall be installed which is found to be defective. Pipe shall be handled to prevent damage to the pipe or

coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of UTILITY or it shall be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on level ground, graded to eliminate all rock points and to provide uniform support along the full pipe length. When being transported, the pipe shall be supported at all times in a manner to prevent distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of the UTILITY, is damaged beyond repair by the CONTRACTOR shall be removed from the site.

- C. The CONTRACTOR shall be responsible for all materials furnished and stored until the date of project completion. The CONTRACTOR shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by the UTILITY, furnish certificates, affidavits of compliance, test reports, samples or check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

2.0 PRODUCTS

2.01 GENERAL

- A. All material supplied shall be from manufacturers that are regular members of the PVC Pipe Association.

2.02 MATERIALS

- D. Polyvinyl Chloride (PVC) Pipe
1. Standards: AWWA C900/C905
 2. Compounds: Class 12454-A or Class 12454-B
 3. PVC Pressure Pipe and Fittings: All PVC pipe of nominal diameter 4 to 12-inches shall be manufactured in accordance with AWWA Standard C900 and greater than 12-inches shall be manufactured in accordance with AWWA Standard C905. The PVC pipe shall have a minimum working pressure rating of 100-psi and shall have a maximum dimension ratio of 18. Pipe shall be the same outside diameter as ductile iron pipe.
 4. Dimension Ratio/Thickness: (unless otherwise shown on the Drawings)
 - a. Reclaimed Water: DR 18
 - b. Raw Water: DR 18
 - c. Potable Water: DR 18
 - d. Wastewater and Sludge: SDR 21
 5. Joints:
 - a. Push-on integral bell elastomeric gasket joints:
 - (1) Standards: ASTM D3212/D3139/F477 and UNI-B-1
 - (2) Gaskets:
 - (a) Potable Water Service: Styrene Butadiene Rubber (SBR) rieber type.
 - (3) Pipe Markings: Pipes shall have a manufacturer's home-mark on the spigot. On field cut pipe, the CONTRACTOR shall provide home-mark on the spigot in accordance with manufacturer's recommendations.
 - b. Solvent weld (nominal diameter less than 4-inches):
 - (1) Standards: ASTM D2466/D2564
 - (2) Type: Slip Fitting Socket (tapered)
 - (3) Exclusions: Plastic saddle and flange joints will not be used.

- c. Restrained Joints:
 - (1) Restrained joint devices shall be made specifically for PVC pipe and meet or exceed the requirements in ASTM F-1674.
 - (2) Manufacturers: Uni-flange mechanical joint restraints and bell restraints (for all sizes); Meg-a-lug system as manufactured by EBBA Iron (sizes 12-inches or less), or acceptable equal.
 - (3) Design pressure rating equal to or above test pressure as specified herein.
- d. Pipe Length:
 - (1) 20-feet maximum nominal length

E. Fittings - Pressure Systems (nominal diameter 4-inches and greater):

- 1. Materials: Ductile iron
- 2. Joints: Mechanical Joint, Minimum 350-psi pressure rating
- 3. Gaskets:
 - a. Potable Water Service: Styrene Butadiene Rubber (SBR) ring type
- 4. Exclusions: Standard double bell couplings will not be acceptable where the pipe will slip completely through the coupling.
- 5. All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron.
- 6. All ductile iron fittings for use in WASTEWATER applications shall have Protecto 401 Ceramic Epoxy lining.
- 7. All buried fittings shall be installed with a bituminous coating in accordance with AWWA C151 and C110 respectively. Buried fittings shall be installed with polyethylene encasement. Polyethylene encasement shall have a minimum thickness of 8 mils and meet or exceed the minimum standards established by AWWA C105, current edition. Acceptable manufacturers include Fulton or approved equal.

F. Fittings - Pressure Systems (nominal diameter less than 4-inches)

- 1. Material: Polyvinyl Chloride (PVC)
- 2. Joints: Slip fitting tapered socket with solvent weld
- 3. Solvent: IPS Weld-On or acceptable equal
- 4. Exclusions: Plastic saddle and flange joint fittings shall not be used

2.03 TRACER WIRE

Refer to Specification in Excavation, Backfilling, and Compacting.

3.0 EXECUTION

3.01 INSTALLATION

G. Standards: AWWA C900/C905/UNI-B 3 and 4

H. Underground Polyvinyl Chloride (PVC) Pipe and Fittings

- 1. Bedding and Backfill: Refer to Part 3.02 below. Blocking under the pipe will not be permitted.
- 2. Placement/Alignment:
 - a. Installation shall be in accordance with lines and grades shown on the Drawings. For pressure systems, deflection of joints shall not exceed 75% of that recommended by the manufacturer.
 - b. All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken or otherwise defective materials are being used. All homing marks shall be checked for the proper length so as to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked on pipe shall result in rejection of pipe and removal from site. The CONTRACTOR shall clean

ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.

- c. Proper implements, tools and facilities shall be used for the safe and proper protection of the Work. Pipe shall be lowered into the trench in such a manner as to avoid any physical damage to the pipe. Pipe shall not be dropped or dumped into trenches under any circumstances.
- d. Trench Dewatering and Drainage Control: CONTRACTOR shall prevent water from entering trench during excavation and pipe laying operations to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.
- e. Pipe Laying in Trench: Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and re-laid. Pigging of pipe may be used to remove foreign materials in lieu of flushing. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the UTILITY to ensure absolute cleanliness inside the pipe. The pipe text shall be viewed from the top of pipe when installed. When installing PVC pipe, no additional joints will be installed until the preceding pipe joint has been completed and the pipe carefully embedded and secured in place.
- f. PVC Pressure Pipe Installation and Training: PVC pipe shall be installed in accordance with standards set forth in the UNI-BELL "Handbook of PVC Pipe", AWWA C605, and AWWA Manual M-23. The pipe shall be laid by inserting the spigot end into the bell flush with the insertion line or as recommended by the manufacturer. At no time shall the bell spigot end be allowed to go past the "insertion line" or "homing mark" for pressure pipe applications and homing mark shall be visible.
- g. Field Cutting: PVC pipe can be cut with a handsaw or power driven abrasive disc making a square cut. The end shall be beveled with a beveling tool, wood rasp or power sander to the same angle as provided on the factory-finished pipe. The insertion line on the spigot shall be remarked to the same dimensions as the factory-marked spigot.
- h. Joint Placement:
 - (1) Push on joints: Pipe shall be laid with the bell ends facing upstream. The gasket shall be inserted and the joint surfaces cleaned and lubricated prior to placement of the pipe. After joining the pipe, a metal feeler shall be used to verify that the gasket is correctly located.
 - (2) Mechanical Joints: Pipe and fittings shall be installed in accordance with the "Notes on Method of Installation" under ANSI A21.11/AWWA C111. The gasket shall be inserted and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.

I. Thrust Restraint

1. Thrust restraint shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein.
2. Length of restrained joints shall be in accordance with the lengths listed in the table as shown on the Drawings.

J. Installation of Pipes on Curves:

1. No joint deflection or pipe bending is allowed in PVC pipe. The maximum allowable

tolerance in the joint due to variances in installation is 0.75° (degrees) (3-inches per joint per 20-foot stick of pipe). No bending tolerance in the pipe barrel shall be acceptable. Alignment change shall be made only with sleeves and fittings.

3.02 BEDDING AND BACKFILL

1. All PVC water pipe shall be bedded in compacted crushed stone extending from 6” below the pipe up to 6” above the pipe. The bedding material shall be installed in lifts not to exceed 6” and compacted to 95% modified proctor density (ASTM D 1557).
2. Common fill meeting the requirements shall be used for the remainder of the backfill, except as modified for special surfaces in Excavation, Backfilling, and Compacting.
3. All trenches shall be backfilled as soon as possible after installation of the pipelines and appurtenances. It may be necessary to backfill only a portion of the trench to allow adequate curing of concrete. The CONTRACTOR shall limit all open trenches to a minimum of 300 linear feet along public streets/highways/roads and shall completely backfill all trenches daily. Temporary road plating of open trenches in paved areas is allowed if approved by the street/road/highway department.
4. All backfilling shall meet the requirement of Excavation, Backfilling, and Compacting

3.03 CLEANING AND FIELD TESTING

- K. At the conclusion of the work, the CONTRACTOR shall provide all associated cleaning and field testing as specified in associated sections of these specifications.

33 34 00

HDPE PRESSURE PIPE

1. GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install and test all high density polyethylene (HDPE) piping, fittings and appurtenances as shown on the Drawings and specified herein.
- B. General Design: The equipment and materials specified herein are intended to be standard types of HDPE pipe and fittings for use in transporting potable water, and Wastewater and sludge under pressure.

1.02 QUALITY ASSURANCE

- A. Qualifications: All of the HDPE pipe and fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed, installed in accordance with the best practices and methods and shall comply with these specifications as applicable.
- B. Standards:
 - 1. AWWA C906
 - 2. PPI – Handbook of PE Pipe
- C. Quality Control:
 - 1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards.
 - 2. In addition to the manufacturer's quality control procedures, the UTILITY may select an independent testing laboratory to inspect the material at the production facility for compliance with these specifications. The UTILITY will pay for the cost of facility inspection requested by the UTILITY.

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted for review and acceptance prior to construction in accordance with the General Conditions and specifications.
- B. Materials and Shop Drawings
- C. Manufacturer's Certification
 - 1. Submit sworn certification of factory tests and their results.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer's recommendations. HDPE pipe shall be covered with black plastic with a minimum thickness of 15-mil. Joint gaskets shall be stored in a clean, dark and dry location until use.
- B. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe or fittings and their respective coatings. Pipe or fittings shall not be rolled off the carrier or dropped. Pipe shall be unloaded by lifting with a forklift or crane. All pipe or fittings shall be examined before installation and no piece shall be installed which is found to be defective. Pipe shall be handled to prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of UTILITY or it shall be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on level ground, graded to eliminate all rock points and to

provide uniform support along the full pipe length. When being transported, the pipe shall be supported at all times in a manner to prevent distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of the UTILITY, is damaged beyond repair by the CONTRACTOR shall be removed from the site.

- C. The CONTRACTOR shall be responsible for all materials furnished and stored until the date of project completion. The CONTRACTOR shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by the UTILITY, furnish certificates, affidavits of compliance, test reports, samples or check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

2.0 PRODUCTS

2.01 GENERAL

- A. All material supplied shall be from manufacturers that are regular members of the Plastic Pipe Institute.

2.02 MATERIALS

- D. High Density Polyethylene (HDPE) Pipe
1. Standards: AWWA C906
 2. PE 4710 meeting cell classification 445574C (ASMT D3350)
 3. HDPE Pressure Pipe and Fittings: All HDPE pipe of nominal diameter 4 to 12-inches shall be manufactured in accordance with AWWA Standard C906. The HDPE pipe shall have a minimum working pressure rating of 200-psi and shall have a maximum dimension ratio of 11. Pipe shall be the same outside diameter as ductile iron pipe.
 4. Dimension Ratio/Thickness: (unless otherwise shown on the Drawings)
 - a. Wastewater and Sludge: DR 11
 5. Joints:
 - a. Heat Fusion Joining:
 - (1) Joints between plain end pipe and fittings shall be made by butt fusion
 - (2) Joints between the main and saddle branch fittings shall be made by using saddle fusion
 - b. Joining by Other Means: Polyethylene pipe and fittings may be joined together or to other materials by means of
 - (1) flanged connections (flange adapters and back-up rings),
 - (2) mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material,
 - (3) MJ Adapters or
 - (4) electrofusion.
- E. Fittings
1. Molded Fittings. Molded fittings shall be manufactured and tested in accordance with ASTM D 3261 and shall be so marked. Molded fittings shall be tested in accordance with AWWA C906.
 2. Fabricated Fittings. Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full-service pressure rating of the mating pipe. Fabricated fittings shall be tested in accordance with AWWA C906.

2.03 TRACER WIRE

Refer to Specification in Excavation, Backfilling, and Compacting.

3.0 EXECUTION

3.01 INSTALLATION

F. Standards: AWWA C906 and PPI Handbook of PE Pipe

1. Bedding and Backfill: Refer to Part 3.02 below. Blocking under the pipe will not be permitted.

3.02 BEDDING AND BACKFILL

1. All HDPE pipe shall be bedded in compacted crushed stone extending from 6" below the pipe up to 6" above the pipe. The bedding material shall be installed in lifts not to exceed 6" and compacted to 95% modified proctor density (ASTM D 1557).
2. Common fill meeting the requirements shall be used for the remainder of the backfill, except as modified for special surfaces in Excavation, Backfilling, and Compacting.
3. All trenches shall be backfilled as soon as possible after installation of the pipelines and appurtenances. It may be necessary to backfill only a portion of the trench to allow adequate curing of concrete. The CONTRACTOR shall limit all open trenches to a minimum of 300 linear feet along public streets/highways/roads and shall completely backfill all trenches daily. Temporary road plating of open trenches in paved areas is allowed if approved by the street/road/highway department.
4. All backfilling shall meet the requirement of Excavation, Backfilling, and Compacting

3.03 CLEANING AND FIELD TESTING

- G. At the conclusion of the work, the CONTRACTOR shall provide all associated cleaning and field testing as specified in associated sections of these specifications.

33 39 13

MANHOLES

1. GENERAL

1.01 WORK INCLUDED

- A. This section covers the materials and procedures used in the construction and repair of sanitary sewer manholes.

1.02 SUBMITTALS

- A. Submit for approval any materials not listed specifically below to the Engineer.
- B. Manhole Ring and Lid
- C. Concrete Manhole Adapter
- D. Inside Drop
- E. Non-Shrink Grout
- F. Manhole joint encapsulation (if required)
- G. Confined space entry equipment

1.03 MANHOLE DIMENSIONS AND LAYOUT

- A. Construct all manholes in accordance with the Standard Manhole Details in Standard Detail Drawings.
- B. The required dimensions on manholes are:
 - 1. Cone section height: 24 inches, minimum; 30 inches, maximum.
 - 2. Throat section height: 12 inches, maximum.
- C. Locate the manhole so the centerlines of all pipelines entering and leaving pass through the center of the manhole.

1.04 PROTECTION

- A. In all cases, the Contractor is responsible for protecting public and private property; and, protecting any person or persons who might be injured as a result of the Contractor's work.
- B. All utilities shown on the plans may not represent the exact location; however, the Contractor is responsible for verifying these locations and contacting "Arkansas One Call System" before excavating.

1.05 MANHOLE RING AND LID

A. This Section describes replacement of manhole ring and lids.

1.06 MANHOLE GRADE ADJUSTMENT

A. This section describes replacement of existing defective manhole rings grade adjustment and the installation of new adjustments where existing manholes must be raised. Installation of new adjustments where existing manholes must be raised will be designated by the Engineer.

1.07 MANHOLE RING AND GRADE ADJUSTMENT SEALING (EXTERNAL)

A. This section governs the materials required and construction procedures for sealing manhole frames and grade adjustments externally.

1.08 SAFETY

A. Contractor shall have the necessary manhole entry equipment for entering a manhole. A tri-pod, harness, gas detector, and other safety equipment for a confined space entry shall be utilized at all times.

2. PRODUCTS

2.01 WATER FOR MORTAR AND GROUT

A. Water: Potable water free from injurious amounts of acids, alkalis, oils, sewage, vegetable matter, and dirt.

2.02 CEMENT

A. Portland Cement, conforming to AASHTO M 85, Type I.

2.03 PRECAST CONCRETE MANHOLES

A. **Pre-cast manholes are not allowed on this project.**

2.04 CAST-IN-PLACE MANHOLES

- A. Construct with Class A concrete only as outlined in Cast-In-Place Concrete.
- B. Reinforcement shall be as outlined in Cast-in-Place Concrete.
- C. The frame for the lid shall be installed when the manhole is constructed.
- D. Cast-in-place manholes are required.

2.05 MANHOLE DROP

A. Inside drop shall be constructed per detail.

- B. No outside drop is allowed unless approved by Engineer.

2.06 STANDARD MANHOLE RING AND COVER

- A. Cover must have the words SANITARY SEWER cast in the top. Cover shall also have the words CONFINED SPACE PERMIT REQUIRED cast in the top. Also, include two closed pick holes in top side of cover.
- B. Minimum combined weights of the manhole ring and cover is 240 pounds. Minimum cover weight is 115 pounds. Minimum ring weight is 125 pounds.
- C. All castings shall be cast with the approved foundry's name, manufacturing foundry mark, part number, and production date in mm/dd/yy format. All castings shall be manufactured in the USA.
- D. All castings: Free from porosity, blowholes, hard spots, shrinkage, distortion and other defects; smooth and well cleaned by sandblasting; manufactured true to pattern.
- E. Ring and cover dimensions: Refer to Standard Detail Drawings. Final casting dimensions may vary one-half the maximum shrinkage possessed by the metal or no more than $\pm 1/16$ inch per foot.
- F. Lid and ring bearing surface: smooth finish, non-rocking design or machined bearing surfaces to prevent rocking and rattling under traffic.
- G. Cast Iron: ASTM A 48, Class 35B.
- H. Ductile Iron: ASTM A 536, Grade 80-55-06.
- I. Frames for standard manholes shall be East Jordan Iron Works or approved equal, and replaced with same size existing frame unless otherwise specified by Engineer.

2.07 REVERSIBLE FRAME/RING

- A. The reversible frame/ring shall be EJ V1600-2 or pre-approved equal. The EJ V1418 cover as specified will fit the V1600-2 frame.
- B. Existing manhole steps shall be removed when relaying, installing and/or pipe bursting into an existing manhole.
- C. Manhole steps shall be removed in existing manholes when installing drops on existing mains and/or service line penetrations.

2.08 WATERTIGHT MANHOLE RING AND COVER

- A. Dimensions, casting quality, material: Same as Standard manhole ring and cover.
- B. Cover: machined with dovetail groove in cover for self sealing rubber gasket.

2.09 MANHOLE STEPS

- A. Manhole steps shall not be installed in manholes.

2.10 RUBBER WATERSTOP GASKETS (CAST-IN-PLACE)

- A. Waterstop gaskets shall be required at **ALL** manhole connections. Manhole seals shall be concrete manhole adapter by Fernco, or approved equal.
- B. The CMA shall not be cut under any circumstances.

2.11 MANHOLE GROUT

- A. The following shall be used for stopping active leaks in concrete and masonry manholes:
 - 1. A premixed fast-setting, volume-stable waterproof cement plug consisting of hydraulic cement, graded silica aggregates, special plasticizing, and accelerating agents. It shall not contain chlorides, gypsums, plasters, iron particles, aluminum powder, or gas-forming agents, or promote the corrosion of steel it may come into contact with. Set time shall be approximately 1-minute. Ten (10) minute compressive strength shall be approximately 500-psi.
- B. The following shall be used for patching, repointing, filling and repairing non-leaking holes, cracks, and spalls in concrete and masonry manholes:
 - 1. A premixed non-shrink cement-based patching material consisting of hydraulic cement, graded silica aggregates, special plasticizing and accelerating agents, which has been formulated for vertical or overhead use. It shall not contain chlorides, gypsums, plasters, iron particles, aluminum powder, or gas-forming agents or promote the corrosion of steel with which it may come into contact. Set time (ASTM C-191) shall be less than 30-minutes. One-hour compressive strength (ASTM C-109) shall be a

minimum of >2,000-psi and the ultimate compressive strengths (ASTM C-882-Modified) shall be a minimum of >3,000-psi.

2. The non-shrink/hydraulic cement shall be Quadex Hyperform, Strong QSR or pre-approved equal.

C. Spray applied or centrifugally cast structural reinforced cement manhole lining.

1. Quadex QM-1 s restore, Permacast MS-10,000, Strong Seal MS-2 or approved equal shall be used on this project. No material (other than clean potable water) shall be used with or added to the coating material without prior approval or recommendation from the coating material manufacturer.

2.12 MANHOLE RISER RING (CAST IRON OR DUCTILE IRON)

A. Manhole riser rings shall be compatible with the size and type of manhole cover with which it will be used.

B. Manhole riser rings shall only be used with written approval from Engineer.

C. Contractor shall submit a request to Engineer for installation of riser rings where pre-cast concrete adjustment rings are not feasible.

2.13 PRE-CAST CONCRETE ADJUSTMENT RINGS

A. Pre-cast concrete grade adjustment rings and flattops shall conform to the requirements of ASTM C-478 and shall be one continuous structure. To accommodate steep surface grades, non-uniform pre-cast adjustment rings may be manufactured so that they are two-inches deep on one side and three-inches deep on the opposite side. In no instance may any non-uniform pre-cast adjustment rings be less than two-inches thick or be of multiple piece construction. Adjustment rings of uniform thickness shall be a minimum of two inches thick and a maximum of 6" thick.

B. The replacement pre-cast grade adjustments shall provide a structural capacity equal to or greater than the existing or specified manhole frame, and shall not affect the opening size or surface appearance.

C. Cracked or multiple piece pre-cast concrete grade adjustment rings will not be accepted.

2.14 SEALING OF RING AND GRADE ADJUSTMENT RINGS

- A. Bitumastic gasket material shall meet or exceed Federal Specification SS-S-210A. The material shall show no signs of deterioration for a period of 30 days when immersed in solutions of acid, alkali or saturated hydrogen sulfide. Joints shall show no sagging when tested at 135F for a period of five days. Bitumastic Gasket Material shall be EZ-STIK or approved equal. Trowelable bitumastic material shall be EZ-STIK or equal.
- B. Bonding agent shall be Quickcrete 990200 or equal.
- C. External sealing shall be SSI Infi-Shield Uni-Band or pre-approved equal. SSI uni-bands are not required unless directed by Engineer, Owner, or Engineer/Owner representative.

3. EXECUTION

3.01 MANHOLES - GENERAL

- A. Perform excavation and prepare base area in accordance with Excavation, Backfilling, and Compacting for Sanitary Sewer.
- B. Never install base in a water filled excavation.
- C. Place base per the Standard Detail Drawings and Cast-in-Place Concrete. Extend base a minimum of six inches beyond finished sides of manhole.
- D. Extend stub-outs entirely through the manhole wall so that a joint occurs approximately 24", but no greater than 48", outside the manhole wall.
- E. Manhole shall be allowed to cure no less than 48 hours prior to backfilling per Excavation, Backfilling, and Compacting.
- F. All new manholes shall have 5' of pipe considered subsidiary to the manhole installation. The 5' only references pipelines entering the manhole which are not being relayed or rehabbed. Any additional pipe shall be paid at the unit price.
- G. No mainline bell is allowed in manhole wall. Straight pipe entering or existing the manhole shall be a minimum of 24" from outside wall. Grouting of all manhole penetrations shall be full width of manhole wall. Contractor shall grout from the inside and outside to achieve full width grouting.

3.02 CAST-IN-PLACE MANHOLES

- A. Dimension shall be as per Standard Detail Drawings. The top section or cone must be concentric with the barrel unless otherwise noted.
- B. The frame shall be set in accordance with Standard Details.
- C. Install rubber waterstop gaskets in the walls around all pipes.
- D. Interior finish: Smooth, free of fins or sharp edges.
- E. Invert to be constructed in accordance with Standard Details.
- F. Care should be taken to prevent the end of the pipe from deflecting, due to loads imposed by the weight of the concrete.
- G. Construction joints on manholes of excessive depth shall be connected with reinforcement approved by the Engineer.

3.03 PRECAST MANHOLES

- A. Dimension shall be as per Detail Drawings. The top section or cone must be concentric with the barrel unless otherwise noted.
- B. The bottom section for pre-cast manholes shall be manufactured as an integral part of the manhole base slab.
- C. Install remaining sections in a truly vertical plane.
- D. Fill space between pipe and periphery of cutout entirely with specified grout.
- E. Grout joints between sections inside and outside.
- F. Interior finish: smooth, free of fins or sharp edges.
- G. Invert to be constructed the same as a cast-in-place manhole.
- H. Grout lifting eyes for manholes.
- I. Outside Joint Wrap
 - 1. All wrapping shall occur after pre-cast manhole has been cleaned and free of debris that would inhibit the seal.
 - 2. Wrap shall be SSI's Gator Wrap, or Engineer approved equal

3.04 DROP MANHOLES

- A. A drop manhole is required when the vertical difference between the influent pipe and effluent pipe invert exceeds two (2) feet.
- B. Construct manhole base, barrel, and top according to the requirements for cast-in-place or pre-cast manholes.

- C. Construct outside drop of ductile iron pipe with mechanical joint fittings and inside drop with PVC as per Standard Details.
- D. Encase the 90-degree bend in Class A or B concrete as per Standard Details.
- E. Extend the ductile iron pipe a minimum of five (5) feet beyond the manhole excavation before changing pipe materials.
- F. Outside drops shall be approved by Engineer in writing.
- G. Contractor shall submit a request with shop drawings to Engineer for construction of an outside drop.
- H. For inside drop, contractor shall grout between bowl and wall with non-shrink grout.

3.05 MANHOLE FRAME AND COVER

- A. Set the manhole frame in Class A concrete as shown on the Standard Details as an integral part of the manhole construction.
- B. Set manhole frame and cover level and to the elevation shown on the Drawings. In public rights-of-way, set the ring and cover flush with pavements, sidewalks, or other paved surfaced areas.
- C. The contractor shall be responsible for supplying the required material for the replacement of manhole frames and covers, including the unloading, temporary storage, and transporting of the materials.
- D. Seal replacement frames to the existing manhole in accordance with these specifications.
- E. Manhole frames that are observed to be cracked, broken, pitted, or contain gaps in the bearing surface preventing a water resistant seal shall be replaced.
- F. All scrap frames and covers from project shall be delivered to owner at a designated area.
- G. In certain instances where the asphalt overlay has exceeded the gutter elevation, the frame shall be set to the gutter elevation and the rum elevation shall be established by riser rings.

3.06 MANHOLE INVERT

- A. Invert depth at the flow line: At least three quarter of the pipe diameter.

- B. In curved inverts, make curves with the longest possible radius to facilitate smooth flow and retain flow characteristics to prevent sediment deposition.
- C. Invert shape: Semicircular.
- D. Invert materials and finish: Class A Concrete, smooth finish.
- E. Invert grade: Constant, smooth grade; no offsets.
- F. Bench: Slope grout upward from the edge of the invert to the manhole wall a minimum of 1:10 slope.
- G. Form a flow channel in the bench for any services stubbed into manhole. Form invert and finish per above.

3.07 MANHOLE REPAIRS

- A. Make all repairs in accordance with these specifications.
- B. Use manhole grout to patch around new services or connections in manhole.

3.08 MANHOLE RISER RING

- A. Manhole riser rings shall only be used to raise manhole covers to grade with written approval from Engineer.
- B. The throat section height shall not exceed 12 inches unless authorized by Engineer. The throat section shall be defined as the distance from the bottom of the integral cast manhole ring to the top of the manhole cover.
- C. Manhole riser rings shall be constructed of the same material as the existing or new ring and lid (Cast Iron or Ductile Iron).

3.09 MANHOLE GRADE ADJUSTMENT RINGS

- A. Existing grade adjustment rings constructed of pre-cast concrete may be reused provided they are not cracked and are in otherwise good condition.
- B. Existing frame grade adjustments that are constructed of brick, block, or materials other than pre-cast concrete rings shall be replaced.
- C. Seal frame and grade adjustments in accordance with these specifications.

3.10 SEALING OF RING AND MANHOLE GRADE ADJUSTMENT RING

- A. Remove manhole frame from the manhole structure. Separate and observe the condition of the grade adjustments. If the grade adjustments are loose, deteriorated, broken, or show structural defects replace them in accordance with these Specifications. Replace adjustments that are

constructed of brick, block, or materials other than pre-cast concrete rings with pre-cast concrete rings, or where necessary, and approved by the RPR, a pre-cast flattop section. Pre-cast concrete and rubber rings, or a pre-cast concrete flattop sections will be the only adjustments allowed.

- B. Wire brush manhole frame and exposed manhole surfaces to remove dirt and loose debris. Coat exposed manhole surfaces with an approved bonding agent followed with an application of a quick setting hydraulic cement to provide a smooth working surface as thin as possible.
- C. Joint surfaces between the frame, adjustments, and cone section shall be free of dirt, stones, debris, and voids to ensure a watertight seal. Place a flexible gasket joint material, minimum 1/2 inch thick, in two concentric rings along the inside and outside edge of each joint. Position the butt joint for each length of joint material on opposite sides of the manhole. No steel shims, wood, stones, or any material not specifically accepted by the RPR may be used to obtain final surface elevation of the manhole frame. If minor elevation adjustment is required to match the existing pavement surface, a hydraulic cement such as Hyperform as manufactured by Quadex or approved equal shall be used to adjust the elevation.
- D. When pre-cast concrete grade adjustment rings are placed on the manhole structure to obtain proper grade, no more than 24 vertical inches may be used, unless approved by the RPR.
- E. In paved areas or future paved areas, castings shall be installed by using a straight edge not less than ten (10) feet long so that the top of casting will conform to the slope and the finish elevation shall be 1/10 above the existing paved surface. The final elevation shall not exceed 1/10 above existing asphalt. If contractor plates the MH area until cured, the plate(s) shall be placed on cold mix above MH ring/lid. Under no circumstances shall plate rest on ring/lid. Allowances for the compression of the joint material shall be made to assure a proper final grade elevation. SSI Uni-Band shall be used to waterproof the exterior of the manhole in accordance with manufacturer's recommendations.

- F. In paved areas where the streets have been overlaid, the contractor shall place the ring at the original surface elevation. The final elevation of the lid shall be accomplished by using riser(s) rings. The municipality shall have the capability to lower the lid elevation to the ring elevation due to milling of street. Contractor shall take original surface elevations from curb and gutter or edge of pavement minus overlay thickness.
- G. Manhole rims in parkways, lawns and other improved lands shall be at an elevation not more than one (1) nor less than one-half (1/2) inch above the surrounding ground. Backfill shall provide a uniform slope from the top of manhole casting for not less than three (3) feet each direction to existing finish grade of the ground. The grade of all surfaces shall be checked for proper slope and grade by string lining the entire area re-graded near the manhole.
- H. Manholes in open fields, unimproved land, or drainage courses shall be set as required by the RPR. All manholes shall be set to an elevation which will not allow storm water runoff to cover ring and lid.
- I. On non-paved manholes, exterior surfaces shall be waterproofed with an SSI Uni-Band in accordance with the manufacturer's specifications.
- J. Testing of Rehabilitated Frame and Grade Adjustment Seals shall be in accordance of these specifications.
- K. For recessed manholes, contractor shall submit to the RPR the methodology of vacuum testing the manhole.

