

CITY OF JOHNSON CITY, TENNESSEE



TN DEPT OF ENVIRONMENT
AND CONSERVATION
DEC 10 2015
DIV OF WATER RESOURCES
RECEIVED

DW 15 1319

STANDARD SPECIFICATIONS
FOR
WATERLINE CONSTRUCTION



APPROVAL EXPIRES
DEC 11 2016
TENN DEPT OF ENVIRONMENT & CONSERVATION
DIVISION OF WATER RESOURCES

APPROVED FOR CONSTRUCTION
THE DOCUMENT BEARING THIS STAMP HAS BEEN RECEIVED AND REVIEWED BY THE
TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
AND IS HEREBY APPROVED FOR CONSTRUCTION BY THE COMMISSIONER

DEC 11 2015

THIS APPROVAL IS VALID FOR ONE YEAR
THE APPROVAL SHALL NOT BE CONSTRUED AS CREATING A PRESUMPTION OF CORRECT
OPERATION OR AS WARRANTING BY THE COMMISSIONER THAT THE APPROVED FACILITIES
WILL REACH THE DESIGN GOAL FOR THE COMMISSIONER

BY _____ TITLE _____

DATE: DECEMBER 2015

PREPARED BY: _____

CITY OF JOHNSON CITY

WATER AND SEWER ENGINEERING DIVISION

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SECTION 01560 TEMPORARY CONTROLS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Provide and maintain methods, equipment and temporary construction, as necessary to provide controls over environmental conditions at the construction site and related areas under Contractor's control; remove physical evidence of temporary facilities at completion of work.

1.02 RELATED REQUIREMENTS

- A. Section 01510: Temporary Utilities
- B. Section 01570: Traffic Regulations
- C. Section 01710: Cleaning

1.03 DUST CONTROL

- A. Provide positive methods and apply dust control materials to minimize raising dust from construction operation, and provide positive means to prevent air-borne dust from dispersing into the atmosphere.

1.04 WATER CONTROL

- A. Provide methods to control surface water to prevent damage to the Project, the site, or adjoining properties.
 - 1. Control fill, grading and ditching to direct surface drainage away from excavations, pits, tunnels and other construction areas; and to direct drainage to proper runoff.
- B. Provide, operate and maintain hydraulic equipment of adequate capacity to control surface and water.

- C. Dispose of drainage water in a manner to prevent flooding, erosion or other damage to any portion of the site or to adjoining areas.

1.05 DEBRIS CONTROL

- A. Maintain all areas under Contractor's control free of extraneous debris.
- B. Initiate and maintain a specific program to prevent accumulation of debris at construction site, storage and parking areas, or along access roads and haul routes.
 - 1. Provide containers for deposit of debris as specified in Section 01710-Cleaning.
 - 2. Prohibit overloading of trucks to prevent spillage on access and haul routes.
 - a. Provide periodic inspection of traffic areas to enforce requirements.
- C. Schedule periodic collection and disposal of debris as specified in Section 01710-Cleaning.
 - 1. Provide additional collections and disposals of debris whenever the periodic schedule is inadequate to prevent accumulation.

1.06 POLLUTION CONTROL

- A. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.
- B. Provide equipment and personnel, perform emergency measures required to contain any spillage, and to remove contaminated soils or liquids.
 - 1. Excavate and dispose of any contaminated earth off-site, and replace with suitable compacted fill and topsoil.
- C. Take special measures to prevent harmful substances from entering public waters.

1. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.
- D. Provide systems or control of atmospheric pollutants.
1. Prevent toxic concentrations of chemicals.
 2. Prevent harmful dispersal of pollutants into the atmosphere.

1.07 EROSION CONTROL

- A. Plan and execute construction and earth work by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
1. Hold the areas of bare soil exposed at one time to a minimum.
 2. Provide temporary control measures such as berms, dikes and drains.
- B. Construct fills and waste areas by selective placement to eliminate surface silts or clays which will erode.
- C. Periodically inspect earthwork to detect any evidence of the start of erosion, apply corrective measures as required to control erosion.
- D. Comply with all erosion control regulations including the TDEC Erosion and Sediment Control Handbook.

1.08 TRENCH SAFETY

- A. Comply with all trench safety guidelines.
- B. Use caution tape at the end of each working day to outline any open trenches.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01570 TRAFFIC REGULATION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Provide, operate and maintain equipment, services and personnel, with traffic control and protective devices, as required to expedite vehicular traffic flow on haul routes, at site entrances, on-site access roads, and parking areas.
- B. Remove temporary equipment and facilities when no longer required, restore grounds to original, or to specified conditions.
- C. Contractor to notify City five working days prior to any traffic closing or diversion. All diversions are to comply with MUTCD standards and guides. All road closings are subject to approval by City of Johnson City.

1.02 RELATED REQUIREMENTS

- A. Section 01530: Barriers
- B. Section 01560: Temporary Controls

1.03 TRAFFIC SIGNALS AND SIGNS

- A. Provide and operate traffic control and directional signals required to direct and maintain an orderly flow of traffic in all areas under Contractor's control, or affected by contractor's operations.
- B. Provide traffic control and directional signs, mounted on barricades or standard posts:
 - 1. At each change of direction of a roadway and at each crossroads.

2. At detours.
3. At parking areas.

1.04 FLAGMEN

- A. Provide qualified and suitably equipped flagmen when construction operations encroach on traffic lanes, as required for regulation of traffic.

1.05 FLARES AND LIGHTS

- A. Provide flares and lights during periods of low visibility:
 1. To clearly delineate traffic lanes and to guide traffic.
 2. For use by flagmen in directing traffic.
- B. Provide illumination of critical traffic and parking areas.

1.06 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to preclude interference with public, traffic or parking, access by emergency vehicles, Owner's operations or construction operations.
- B. Monitor parking or construction personnel's private vehicles:
 1. Maintain free vehicular access to and through parking areas.
 2. Prohibit parking on or adjacent to access roads, or in non-designated areas.

1.07 HAUL ROUTES

- A. Consult with governing authorities, establish public thoroughfares which will be used as haul routes and site access.
- B. Confine construction traffic to designated haul routes.

- C. Provide traffic control at critical areas of haul routes to expedite traffic flow, to minimize interference with normal public traffic.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

There will be no direct payment to the Contractor for the work required in this section. Contractor shall include the work to comply with these regulations with the bid items listed in the Bid Proposal.

END OF SECTION

SECTION 01710 CLEANING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Execute cleaning, during progress of the Work, and at completion of the Work, as required by General Conditions.

1.02 RELATED REQUIREMENTS

- A. Conditions of the Contract.
- B. Section 02221: Trenching, Backfilling and Compaction
- C. Section 02845: Lawn and Grass Landscaping
- D. Each Specification Section: Cleaning for specific Products or work.

1.03 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

- A. Execute periodic cleaning to keep the Work, the site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations.
- B. Provide on-site containers for the collection of waste materials, debris and rubbish. Place containers where they do not interfere with parking, deliveries, or daily operations.
- C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.
- D. Clean-up, including placement of gravel roadway or of seed, shall not lag behind trenching and excavation by more than 400 linear feet.

3.02 FINAL CLEANING

- A. Employ skilled workmen for final cleaning.
- B. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
- C. Prior to final completion, or Owner occupancy, Contractor shall conduct an inspection of all work areas to verify that the entire work area is clean.

END OF SECTION

SECTION 01720A OPERATIONAL DEFINITIONS FOR WATER LINE AS-BUILT NOTES

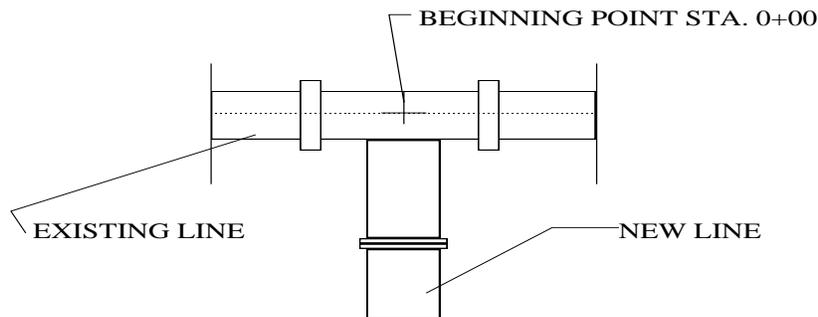
PART 1 GENERAL

OBJECTIVE

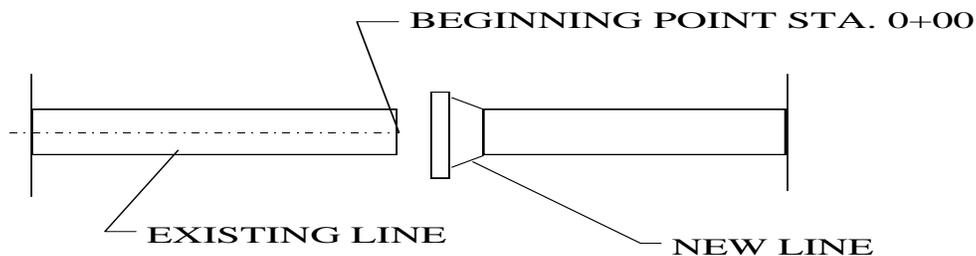
To create a standard process to accurately gather field measurements and other information on water line installations. This information will be transferred from the installation plans to the original design drawings for future reference as well as incorporated into the Johnson City Geographic Information System. As-builts shall be submitted in digital and paper form.

- A. All water line projects will have a beginning point and this point shall be defined as the point at which the new line connects to an existing line. For water lines there will be two (2) types of beginning points:

- a) Perpendicular-the beginning point will be defined as the centerline of the existing line.



- b) Extension- the beginning point will be defined as the end of the existing line.



- B. The beginning point in both of the above mentioned cases will be noted as : STA 0+00

- C. All measurements made during the installation process will be made using a standard engineer's tape which is graduated in increments of feet and tenths of feet. All measurements made shall be carried to the nearest tenth of a foot.



- D. All tees, bends, valves, reducers or any other underground utilities encountered will be measured from the beginning point (STA 0+00) along the centerline of the new line to the point at which the item is inserted.
- E. For each inserted item there will be at least three (3) referenced measurements. The first required measurement will be a "station number". The next two (2) measurements will be made referencing to surrounding permanent features such as:
- a) man holes or fire hydrants
 - b) power/telephone poles
 - c) property corners
 - d) permanent surveying control points such as TDOT, TVA, USGS etc.
 - e) face of curb or edge of pavement
- F. All measurements shall be legibly recorded in the appropriate place on the field installation plans.

END OF SECTION

SECTION 02110 CLEARING AND GRUBBING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Clearing, grubbing, removal and disposal of vegetation, rocks, roots and debris within the limits of the work except objects designated on the drawings to remain.
- B. Preserve from injury or defacement all vegetation and objects to remain.
- C. Streets are to remain clear of dirt, debris and mud while hauling away materials to an offsite location.

1.02 RELATED WORK

1.03 LIMITS OF WORK

- A. Rights-of-way area established by Engineer.
- B. Construction area including the area bounded by any written permanent and temporary construction easements as established by Engineer.
- C. Approved borrow pit areas.
- D. Designated stockpiles of construction material other than borrow material.

1.04 PROTECTION

- A. Protect living trees not marked for removal and outside the construction area. Treat cut or scarred surfaces of trees or shrubs with a paint prepared especially for tree surgery.
- B. Protect bench marks and existing structures, roads, sidewalks, paving and curbs against damage from vehicular or foot traffic.
- C. Maintain designated temporary roadways, walkways and detours, for vehicular and pedestrian traffic.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 PREPARATION

- A. Maintain benchmarks, monuments and other reference points. Re-establish if disturbed or destroyed at no cost to Owner.

3.02 CLEARING AND GRUBBING

- A. Clear rights-of-way, borrow pit and other stockpile areas of objectionable material to the ground surface except for trees and stumps.
- B. Cut trees and stumps to within six inches of the ground surface or low water level in swampy areas where embankments are to be constructed provided undercutting or other corrective measures are not stipulated.
- C. Cut trees and stumps outside the construction area marked for removal by the Engineer to within six inches of the ground surface.

- D. Remove low hanging, unsound or unsightly branches on trees or shrubs designated to remain.
- E. Trim branches of trees extending over the roadbed to a clear height of twenty feet above the roadbed surface.
- F. It is the Contractors responsibility to check with a forester to be sure the trees do not die as a result of the trimming.
- G. Grub construction area of protruding obstructions except sound undisturbed stumps and roots six inches or less above the ground which will be a minimum of 5 feet below sub-grade or embankment slope provided undercutting, topsoil stripping or other corrective measures are not stipulated.
- H. Grub borrow pit and stockpile areas of all objectionable material. Strip overburden over the material to be obtained in stockpile areas.
- I. Perform clearing and grubbing well in advance of construction or material removal activities.

3.03 BACKFILLING AND SURFACE PREPARATION

- A. Backfill and compact all depressions resulting from clearing and grubbing with suitable materials in accordance with Section 02210.
 - 1. Backfill embankment areas to natural ground elevation.
 - 2. Backfill excavation areas below finished sub-grade to finished sub-grade.
- B. Perform backfilling a satisfactory distance ahead of construction operations.
- C. Prepare areas designated on the drawings to receive erosion control matting to smooth surfaces that have been shaped, fertilized and seeded.

3.04 DEBRIS REMOVAL

- A. Promptly remove cleared debris from site.
- B. Obtain permission from applicable regulatory authority for disposal of debris to waste disposal site.

END OF SECTION

SECTION 02221 TRENCHING, BACKFILLING, AND COMPACTION

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Excavation for piped utility material.
- B. Provide necessary sheeting, shoring and bracing.
- C. Prepare trench bottom with appropriate materials.
- D. De-water excavation as required in accordance with TDEC regulations.
- E. Place and compact granular beds, as required, and backfill.

1.02 RELATED WORK

- A. Section 02110: Clearing and Grubbing
- B. Section 02480: Pavement Replacement
- C. Section 03001: Concrete Work

1.03 PRECAUTIONS

- A. Notify Tennessee One-Call when necessary to locate, and protect existing utilities or when necessary to disturb existing utility facilities and abide by their requirements for repairing and replacing. Call three working days prior to excavation at 1-800-351-1111.
- B. Protect all vegetation and other features to remain. Minimize damage to all existing trees, shrubs, and flowers.

- C. Protect all benchmarks and survey points. Property corners determined by the engineer to be carelessly destroyed by contractor shall be replaced at no cost to City. Replacement shall be performed by a Registered Land Surveyor (TN) and approved by engineer.

PART 2 PRODUCTS

2.01 BEDDING AND BACKFILL MATERIALS - WATER LINES

- A. Class I Material: Angular, 1/4 to 1 inch graded stone including a number of fill materials that have regional significance such as crushed stone, cinders, slag and crushed shells meeting the following gradation requirements:

<u>SIEVE SIZE</u>	<u>PERCENT PASSING</u>
1"	100
3/4"	90-100
3/8"	20-55
#4	0-10
#8	0-5

- B. Class II Material: Coarse sands and gravels with a maximum particle dimension of 1-1/2 inch including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry.
- C. Class III Material: Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures.
- D. Class IV Material: Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits.
- E. Class V Material: Organic soils, as well as, soil containing frozen earth, debris, rocks larger than 1-1/2 inches and other foreign material.

PART 3 EXECUTION

3.01 PREPARATION

- A. Install barriers and other devices to protect areas adjacent to construction.
- B. Protect and maintain all benchmarks and other survey points.

3.02 EXCAVATION TRENCHES

- A. Perform in such a manner as to form a suitable trench in which to place the pipe and so as to cause the least inconvenience to the public.
- B. Maximum width at the crown of the pipe-2 feet plus the nominal diameter of the pipe.
- C. Cut pavement along neat, straight lines with either a pavement breaker or pavement saw.
- D. Align trench as shown on the Plans unless a change is necessary to miss an unforeseen obstruction.
- E. When unstable soil is encountered at the trench bottom, remove it to a depth required to assure support of the pipeline, as approved by the engineer, and backfill to the proper grade with coarse aggregate AASHTO M-43, Size No. 2 or 3. The contractor shall keep a record of the tonnage of stone placed for stabilization and submit stone tickets to the owner.
- F. Remove rock encountered in trench excavation to a depth of 6 inches below the bottom of the pipe barrel, backfill with and crushed stone, and compact to uniformly support the pipe. In no case shall solid rock exist within six (6) inches of the finished pipeline. When solid rock is encountered or stone bedding is necessary, copies of the delivery tickets for bedding material are to be given to the owner.
- G. When rock borings or soundings are provided, they are for information only and do not guarantee existing conditions. Make such investigations as deemed necessary to determine existing conditions.

3.03 SHEETING, SHORING AND BRACING

- A. When necessary or when directed by the Engineer, furnish, put in place, and maintain such sheeting, bracing, etc., as may be required to support the sides of

the excavation and to prevent movement. Sheeting, shoring, etc., shall meet OSHA safety requirements.

- B. Take care to prevent voids outside the sheeting.
- C. If voids are formed, immediately fill and ram to the satisfaction of the Engineer.
- D. Devise plans for performing this work subject to the approval of the Engineer.
- E. Unless adjacent facilities will be injured, remove all sheeting, shoring, and bracing after backfill has been placed to a depth of 18 inches over the pipeline.
- F. Cut shoring off at the top of the pipe and leave the lower section in the trench.

3.04 USE OF EXPLOSIVES

- A. Conduct all blasting operations in accordance with prevailing municipal, state or other agency regulations, codes, ordinances, or laws.
- B. Exercise due caution when blasting adjacent to existing structures and pipelines.
- C. If structures or pipelines are damaged, promptly replace or repair them at no expense to Owner.
- D. Do not conduct blasting operations within 25 feet of water, sewer, gas or other utility lines, unless otherwise directed by Engineer and approved by utility owner.
- E. Cover all shots with blasting mats to prevent flying material.

3.05 DISPOSAL OF EXCAVATED MATERIAL

- A. Satisfactorily dispose of all excess excavated material that cannot be used or is not suitable for embankments. The owner is not responsible for disposed material in any regard including any possible regulatory action by local, state, or federal agencies.

3.06 UNAUTHORIZED EXCAVATION

- A. All excavation outside or below the proposed lines and grades shown on the Plans is prohibited unless directed by the Engineer.
- B. Backfill areas of unauthorized excavation with the type material necessary (earth, rock or concrete) to insure the stability of the structure of construction involved.

3.07 REMOVAL OF WATER

- A. Keep excavated areas free of water while work is in progress in accordance with TDEC regulations.
- B. Well-pointing shall be performed if required.
- C. Take particular precautions to prevent the displacement of structures or pipelines as a result of accumulated water.

3.08 OBSTRUCTIONS

- A. Obstructions shown on the Plans are for information only and do not guarantee their exact locations nor that other obstructions are not present.
- B. When unforeseen utilities or obstructions are encountered during installation of pipeline, the contractor may submit a request to relocate the proposed pipeline or obstruction. The request shall detail the length of the relocation and any additional bends, bedding materials, and other items needed.

- C. Exercise due care in excavating adjacent to existing utilities and structures and do not disturb same unless absolutely necessary. The contractor shall notify the utility owner when working within close proximity of their line.
- D. In the event utilities or structures are disturbed, repair or replace as quickly as possible to the condition existing prior to their disturbance.
- E. If desired by the disturbed utility owner, repair or replacement of disturbed utility may be performed by the forces of the utility company or other appropriate party at no expense of City of Johnson City.
- F. If replacement or repair of disturbed obstructions is not performed after a reasonable period of time, the Owner may have the necessary work done and deduct the cost of same from payments to the Contractor.

3.09 INITIAL BACKFILLING

- A. Do not begin backfilling before the Engineer has inspected the grade and alignment of the pipe, the bedding of the pipe, and the joints between the pipe. If backfill material is placed over the pipe before an inspection is made, reopen the trench in order for an inspection to be made.
- B. Perform backfilling by hand, together with tamping, until fill has progressed to 18" above the top of the pipe.
 - 1. Deposit Class I granular material (where required) or loose soil free from lumps, clods, frozen material or stones in layers approximately 6" thick.
 - 2. Compact by hand, or with manually operated machine tampers actuated by compressed air or other suitable means.
 - 3. Use tamps and machines of a suitable type which do not crush or otherwise damage the pipe.

3.10 FINAL BACKFILLING

- A. After the backfill has reached a point 18" or more above the top of the pipe, perform final backfilling depending upon the location of the work and danger from subsequent settlement.

- B. Backfilling in Unimproved Areas:
 - 1. Dispose of and replace all soft or yielding material which is unsuitable for trench backfill with suitable material.
 - 2. Deposit backfill to the surface of the ground by dragline, bulldozer, or other suitable equipment in such a manner so as not to disturb the pipe.
 - 3. Neatly round sufficient surplus excavated material over the trench to compensate for after settlement.
 - 4. Dispose of all surplus excavated material.
 - 5. Prior to final acceptance, remove all mounds to the elevation of the surrounding terrain.

- C. Backfilling Beneath Driveways and Streets where Non-Rigid and Rigid Type Surfacing is to be Replaced:
 - 1. Use select backfill material, crushed limestone, or crushed gravel of high weight and density, as directed by the Engineer.
 - 2. Carefully deposit in uniform layers, not to exceed 12" thick, compacted to at least 95 percent standard proctor but not less than a minimum of 90 lb/ft³ dry density.
 - 3. Compact each layer thoroughly by rolling, ramming and tamping with tools suitable for that purpose in such a manner so as to not disturb the pipe.

- D. Backfilling Beneath Streets
 - 1. Backfilling methods and materials beneath the street shall be flowable fill in accordance with the requirements of the City of Johnson City in accordance with Section 02300.
 - 2. The pipe shall be covered with Class 1 material 6" – 12" above the top of the pipe.
 - 3. The flowable fill shall be placed up to 3" from the pavement surface (or to the base of the existing pavement).

- E. Backfilling of Shoulders Along Streets and Highways:
1. Backfilling methods and materials for shoulders along streets and highways shall be in accordance with the requirements of governing local, county, or state departments maintaining the particular roadway or highway.
 2. Replace with similar materials, all shoulders which may be damaged or destroyed as a result of pipe trenching.
 3. Where shoulders along state highways have seal coat surfaces replace with double bituminous seal in accordance with Section 02480.
- F. Crushed Stone or Pavement Maintenance and Shoulder Replacement:
1. Where possible, salvage and reuse all base material that is removed during construction.
 2. Wet and thoroughly compact crushed stone and blade to tie into the existing surface prior to final acceptance.
 3. Base material placed as a portion of pavement replacing items, will not be directly measured for payment.

END OF SECTION

SECTION 02300 HIGHWAY, STREET, AND RAILWAY CROSSINGS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. All pipelines crossings highways, streets, railroads and elsewhere if shown on the plans, shall be installed in a casing pipe by boring or jacking unless open cut or tunneling is specifically called for on the plans or permitted by the Engineer. Open cut operations shall be backfilled with flowable fill.
- B. Highway and street crossings, except where open cut is permitted, shall be constructed with no interruption of traffic. Where open cut is permitted not more than one half of the traveled way shall be closed to traffic at any one time.
- C. Permits or permission for work along federal, state and county highways as well as crossing permits will be obtained by the Contractor, and he shall cooperate closely with the Department of Highways and the Railroads during the construction of the crossings.

PART 2 PRODUCTS

2.01 CARRIER PIPE

- A. Carrier pipe and joints shall be of accepted material and construction as provided in these specifications, subject to the approval of the Department of Highways and the Railroads. Joints for carrier line pipe operating under pressure shall be mechanical "O" Ring push-on or welded type. The pipe shall be laid with sufficient slack (no tension) in the line or with an expansion joint near the point of crossing.

2.02 CASING PIPE

- A. Casing pipe and joints shall be of leak-proof construction, and conform to the following:

TABLE OF MINIMUM WALL THICKNESS FOR STEEL CASING PIPE	
Normal Thickness	Normal Diameter
<u>Inches</u>	<u>Inches</u>
0.188	Under 14
0.219	14 & 16
0.250	18
0.281	20
0.312	22
0.344	24
0.375	26
0.406	28 & 30
0.438	32
0.469	34 & 36
0.500	38, 40 & 42

Steel pipe shall have a minimum yield strength of 35,000 psi.

- B. Casing pipe shall have a bituminous coating, applied cold, which shall be Koppers Company, Inc., bitumastic No. 50, Reilly Ca No. 5, Barrett Coal Tar Paint No. 34 YB, approved equal. The coating shall be applied in accordance with the manufacturer's directions. The coating shall be thinned only when permitted by the Engineer and then with not more than 5 percent of an approved solvent. The consistency of the coating shall be such that it can be applied easily with a brush or spray in one coat to a coverage not greater than 70 square feet per gallon on smooth metal. One coat approximately 1/32-inch thick on a plate suspended vertically shall show no appreciable flowing or sagging while still wet. The material shall dry to a firm film within 24 hours at 75 degrees F to 80 degrees F, at a spreading rate 70 square feet per gallon.
- C. When casing is installed without benefit of a protective coating, the wall thickness shown above shall be increased to the nearest standard size, which is a minimum of 0.063 inches greater than the thickness shown except for diameters under 12-3/4 inches.
- D. Cast iron pipe may be used for casing provided the method of installation is by open trench. Cast iron pipe shall conform to American Standard's Association Specification A21. The pipe shall be of the mechanical joint type or plain end pipe with compression type couplings. The strength of cast iron pipe to sustain external loads shall be computed in accordance with ASA A21.1 "Manual for the

Computation of Strength and Thickness of Cast Iron Pipe."

- E. The inside diameter of the casing pipe shall be at least Three (3) inches greater than the largest outside diameter of the carrier pipe, joints or couplings, for carrier pipe less than six inches in diameter; and at least four (4) inches greater for carrier pipe six inches and over in diameter. It shall, in all cases, be great enough to allow the carrier pipe to be removed subsequently without disturbing the casing pipe or roadway.

2.03 FLOWABLE FILL

- A. Excavatable flowable fill concrete shall be mixed in conformance to ACI 229R-94 – Controlled Low Strength Materials (CLSM). The mix design for flowable fill shall result in a finished product excavatable by machine equipment with a maximum strength of 150 psi.

PART 3 EXECUTION

3.01 INSTALLATION- CASING PIPE

- A. Casing pipe shall be so installed as to prevent leakage of any substance from the casing throughout its length, except at ends. Casing shall be so installed as to prevent the formation of a waterway under the roadway with an even bearing throughout its length, and shall slope to one end.
- B. Installation by open trench methods shall comply with Department of Highways Specifications covering "Installation of Pipe Culverts."
- C. Bored or jacked installations shall have a bored hole diameter essentially the same as the outside diameter of the casing pipe plus the thickness of the protective coating. If voids shall develop or if the bored hole diameter is greater than the outside diameter to the pipe (including coating) by more than approximately one inch, remedial measures as approved by the Engineer shall be taken. Boring operations shall not be stopped if such stoppage would be detrimental to the highway or railroad.
- D. Where the ends of the casing are below ground, they shall be suitably protected against the entrance of foreign material, but shall not be tightly sealed.
- E. Where the ends of the casing are at or above ground surface and above high water level, they may be left open, provided drainage is afforded in such a manner

that leakage will be conducted away from roadway or structures.

- F. Casing pipe under primary highways or railroads shall have a clear dimension of not less than 4 feet from the top of roadway to top of casing at its closest point. Under secondary roads this distance may be three (3) feet.
- G. Bedding, haunching and backfill material for open cut installation of casing pipe shall be crushed stone.

3.02 INSTALLATION – FLOWABLE FILL

- A. The pipe shall be covered with Class 1 material 6” – 12” above the top of the pipe.
- B. Flowable fill backfill will be placed to 12” above the top of the pipe up to 3” from the pavement surface (or to the base of the existing pavement).
- C. The trench shall be covered with steel plates and a warning construction “BUMP” sign shall be placed before the plates.
- D. After 24 hours the plates shall be removed and the remaining trench depth shall be paved in accordance with Section 02480. The maximum time that can lapse between pouring the flowable fill and paving is one week.

END OF SECTION

SECTION 02479 BASE TREATMENT FOR ASPHALT PAVEMENT REPAIR

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Placing and compacting base material.

1.02 RELATED WORK

- A. Section 02110: Clearing and Grubbing
- B. Section 02221: Trenching, Backfilling and Compaction
- C. Section 02479: Base Treatment for Asphalt Pavement Repair
- D. Section 02480: Pavement Replacement

1.03 REFERENCE STANDARDS

- A. Compact all Sub-grade materials to 100% of maximum density unless otherwise specified.
 - 1. Determine maximum density and optimum moisture in accordance with the "Standard Method of Test for Moisture Density Relationship of Soils Using a 5.5 Pound Rammer and a 12-inch Drop", AASHTO Designation T 99, Method A.
- B. Compact Type I Base materials to an average dry density of at least 100% of theoretical density based upon 83% of a solid volume, unless otherwise specified.
 - 1. No individual test shall be less than 97% of theoretical density.

2. The theoretical density of limestone aggregates shall be based on bulk specific gravity AASHTO T-85.
 3. The theoretical density of all other aggregates shall be based on bulk specific gravity AASHTO T-84 and T-85.
- C. Compact Type II Base materials to at least 95% of maximum density, unless otherwise specified.
1. No individual test shall be less than 92% of maximum density. Determine maximum density and optimum moisture in accordance with the "Standard Method of Test for Moisture Density Relationship of Soils Using a 5.5 Pound Rammer and a 12-inch Drop", AASHTO Designation T 99, Method D.

PART 2 PRODUCTS

2.01 MINERAL AGGREGATE MATERIALS - GENERAL

- A. Mineral aggregate: sound, tough, and durable fragments of crushed stone, crushed slag, crushed or uncrushed gravel or chert.
- B. Fine aggregate: natural sand, silt-clay or other inert materials with similar characteristics conforming to AASHTO M-6, M-29 and M-45 requirements except as specified herein.
- C. Coarse aggregate: AASHTO M-43, except as specified herein, consisting of crushed stone, crushed slag, crushed or uncrushed gravel, crushed or uncrushed chert, or a combination thereof, or other inert materials with similar characteristics, having hard strong durable pieces free from adherent coatings.
- D. Coarse aggregates: graded to standard sizes between the limits specified and to the gradation requirements set forth in the following table:

2.02 MINERAL AGGREGATE BASE MATERIALS

A. Base aggregates shall conform to the requirements of article 2.01 and shall be of two classes: Type I and Type II.

B. Base aggregate gradations:

Grading C	
Sieve Size	Percent Passing by Weight
1-1/2"	100
1"	90-100
3/8"	40-65
No. 100	4-15
Grading D	
1-1/2"	100
1"	85-100
3/4"	60-95
3/8"	50-80
No. 4	40-65
No. 16	20-40
No. 100	9-18

C. Type I aggregate: crushed stone, crushed slag, crushed gravel or crushed chert and other fine grained mineral matter.

1. Crushed stone: free from adherent coatings, clay, or other soils with wear not exceeding 50% and sodium sulfate soundness loss not exceeding 15%.
2. Crushed slag: quality as for crushed stone having a uniform density.
3. Crushed gravel and chert: screened and all oversize material crushed and fed back over the screen in a uniform manner.
4. Coarse aggregate wear for those retained on the No. 4 sieve shall not exceed 30%.
5. Material passing the No. 40 sieve: non-plastic, or with a liquid limit not exceeding 25 and a plasticity index not exceeding 6.
6. Only grading D aggregate shall be used.

D. Type II aggregate: crushed stone, crushed slag, crushed or uncrushed gravel, crushed or uncrushed chert, or a combination of these materials, and other fine grained material. The quality of Type II aggregate shall be the same as for Type I aggregate except as follows:

1. Gravel or chert: screened and the oversize material wasted or crushed and blended in a uniform manner with the remainder of the material.
 2. Gravel or chert: no more than 12% clay.
 3. Coarse aggregate wear for those retained on the No. 4 sieve shall not exceed 40%.
 4. Additional binder or mineral aggregate may be incorporated into the material to meet gradation, density, or bonding requirements.
 5. Grading C or D shall be used.
- E. Furnish test reports on quality of all aggregates for approval by the Engineer prior to blending or mixing. If requested by the Engineer, furnish samples for testing by an independent laboratory. Test methods for aggregate base quality shall be by the following AASHTO methods:

Test	Method
Sampling	T-2
Percentage of wear	T-96
Soundness	T-104
Unit weight	T-19
Sieve analysis	T-27

PART 3 EXECUTION

3.01 PREPARATION

- A. Clear construction areas as stipulated in Section 02110.
- B. Maintain benchmarks, monuments and other reference points.

3.02 PLACING AGGREGATE BASE

- A. Base course shall consist of a 6 inch thickness of approved materials.
- B. Base shall be maintained at Contractor's expense until final pavement placement.

- C. Install base course immediately after placement and compaction of trench backfill material. Maintenance shall include, filling pot holes, work necessary to confine stone to trench area by sweeping with mechanical sweepers, and watering surface for dust control.
- D. The sub-grade shall be checked and approved by the Engineer at least 500 feet in advance of spreading any mineral aggregate. This distance may be shortened by permission of the Engineer to as little as 200 feet between November first and April first or during periods of prolonged wet weather.
- E. Mineral aggregate bases shall not be spread on a sub-grade that is frozen or contains frost.
- F. Hauling over material already placed will not be permitted until it has been spread, mixed, shaped and compacted to the required density.
- G. All pavement which has been damaged by settlement of backfill shall be removed.

3.03 COMPACTING AGGREGATE BASES

- A. For compaction testing purposes, each completed layer will be divided into lots of approximately 10,000 square yards. Smaller lots may be considered when approved by the Engineer.
- B. Five density tests will be performed on each lot and the results averaged.

END OF SECTION

SECTION 02480 PAVEMENT REPLACEMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Preparation, placement, and compaction of a mineral aggregate base.
- B. Preparation, placement, and compaction of bituminous pavements.
- C. Preparation and placement of Portland cement concrete pavements.

1.02 RELATED WORK

- A. Section 02221: Trenching, Backfilling and Compaction

PART 2 PRODUCTS

2.01 GENERAL

- A. All materials shall conform to those as specified on the plans or by the Engineer.
- B. Materials to replace State Highway paving shall conform to the specifications set forth by the Tennessee Department of Transportation.

PART 3 EXECUTION

3.01 PREPARATION

- A. Prior to replacing concrete or asphalt pavement, a six inch rock base shall be placed and compacted according to TDOT #303.
- B. Apply a tack coat of asphalt to the vertical sides of cut pavement to assure a good bond and seal between old and new pavements.

3.02 PAVEMENT REPLACEMENT

- A. Where concrete pavement is replaced minimum thickness shall be six inches.
- B. Concrete for paving shall have a minimum compressive strength of 3000 psi.
- C. Contractor should follow terms of the required excavation permit. Asphalt paving shall consist of a prime coat (TDOT #402), three inches of bituminous base course binder (TDOT #307), tack coat (TDOT #403), and a one and one-half inch (1 1/2") inch asphaltic concrete surface course (TDOT #411) after compaction.
- D. Unless otherwise approved by the Owner, place in accordance with the temperature limitations of the following table and only when weather conditions otherwise permit the pavement to be properly placed, compacted and finished.

Compacted Thickness	Minimum Air Temperature or Surface Temperature (whichever is less)
Less than 1½"	50° F
Greater than 1½"	40° F

END OF SECTION

SECTION 02485 LAWN AND GRASS LANDSCAPING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Preparation of landscape area including loosening, pulverizing and fertilizing.
- B. Placement of seed, sprigging, sod and topsoil including mulch, where required.
- C. Watering of landscaping.

1.02 RELATED WORK

- A. Section 02110: Clearing and Grubbing

PART 2 PRODUCTS

2.01 SEED MATERIALS

- A. Inspect and test seed for germination and purity prior to mixing.
- B. Uniformly mix by Group:

Seeding Dates	Grass Seed	Percentages
February 1 to July 1	Kentucky 31 Fescue	80%
	Korean Lespedeza	15%
	English Rye	5%
June 1 to August 15	Kentucky 31 Fescue	55%
	English Rye	20 %
June 1 to August 15	Korean Lespedeza	15%
	German Millet	10%

April 15 to August 15	Bermudagrass (hulled)	70%
	Annual Lespedeza	30%
August 1 to December 1	Kentucky 31 Fescue	70%
	English Rye	20%
	White Clover	10%
February 1 to December 1	Kentucky 31 Fescue	70%
	Crown Vetch	25%
	English Rye	5%

- C. All seed shall meet the requirements of the Tennessee Department of Agriculture.
- D. Furnish the Engineer a certified laboratory report showing the analysis of the seed to be furnished. The report shall bear the signature of a senior seed technologist.
- E. Inoculate for Legumes:
 - 1. Nitrogen fixing bacteria cultures adapted to the particular seed to be treated.
 - 2. Furnish in containers of a size sufficient to treat the specified quantity of seed to be planted.

2.02 MULCH MATERIALS

- A. Hay composed of approved stalks from grasses, sedges, or legumes; or straw composed of stalks from rye, oats, wheat, or other approved grains.
- B. Air dried and reasonably free from noxious weeds, weed seeds, and other detrimental plant growth.
- C. Suitable for spreading with mulch blower machinery.
- D. Wood fiber mulch, when used, shall meet the following specifications.
 - 1. Moisture Content 10% ± 2%
 - 2. Organic Matter 99.4% ± 0.2%
 - 3. Ash Content 0.6% ± 0.2%
 - 4. Water Hold Capacity (per hundred...1050 grams minimum grams of oven dry fiber)

E. Mulch Binders:

1. Cut back asphalt, Grade RC-70 or RC-250 conforming to AASHTO M-81, M 82 of M-141, for the type and grade specified.
2. Emulsified asphalt, Type SS-1 conforming to AASHTO M-140. In addition to Type SS-1, a special mixing material AE-3 or a special priming material AE-P may be specified.

2.03 JUTE MESH

- A. Open plain weave of single jute yarn and non-toxic to vegetation.
- B. Tag jute rolls for identification with 58 warp ends per yard, 41 weft ends per yard and weighing approximately 0.9 pounds per square yard with an acceptable tolerance of 5 percent.

2.04 STAPLES

- A. New and unused, machine made of No. 11 gauge steel wire formed into a "U" shape.

2.05 SOD MATERIALS

- A. Live dense, well-rooted growth of permanent grasses, free from Johnson grass, nutgrass, and other undesirable grasses or weeds and well-suited for the proposed application to particular soils.
- B. Cleanly cut in strips having a reasonably uniform thickness of not less than 2-1/2 inches, a uniform width of approximately 8 inches, and a minimum length of 12 inches.

2.06 COMMERCIAL FERTILIZERS

- A. Unless otherwise specified, inorganic 10-20-10 nitrogen, phosphoric acid, and potash for seeding and 15-15-15 or 1-1-1 for sodding.
- B. Furnish in standard containers with the brand name, weight and guaranteed analysis of the contents clearly marked.
- C. Comply with Federal, State and local laws.
- D. Ammonium Nitrate shall be a standard commercial product, having a minimum of 33.5 percent nitrogen.
- E. Agricultural limestone shall contain a minimum of 85% of calcium carbonate and magnesium carbonate combined, and be of particular size that 85% will pass a No. 10 mesh sieve.

2.07 WATER

- A. Free from harmful organisms or other objectionable materials.

2.08 TOPSOIL

- A. Natural, friable fertile, fine sandy loam possessing characteristics of representative topsoil in the vicinity which produce heavy growths of vegetation.
- B. Free from subsoil, noxious weeds, stones larger than one inch in diameter, lime, cement, ashes, slag or other deleterious matter.
- C. Well drained in its original position and free from toxic quantities of acid or alkaline elements.

PART 3 EXECUTION

3.01 SEEDING

- A. Scarify, disc, harrow, rake, or otherwise work each area to be seeded until it has been loosened and pulverized to a depth as directed by the Engineer.
- B. Uniformly incorporate fertilizer into the soil for a depth of approximately 1/2" at the rate of:
 - 1. Not less than 20 lbs. per 1000 square feet for grade 10-10-10 or equivalent.
 - 2. Not less than 100 lbs. per 1000 square feet for agricultural limestone.
- C. Fertilizer need not be incorporated in the soil as specified above when mixed with seed in water and applied with power sprayer equipment.
- D. Sow seed of the specified group as soon as preparation of the seed bed has been completed.
- E. Sow uniformly by means of a rotary seeder, hydraulic equipment, or other satisfactory means at the rate of 10 pounds per 1,000 square feet, unless otherwise specified.
- F. Inoculate Group "C" seed and seeds of legumes, when sown alone, before sowing in accordance with the recommendations of the manufacturer of the inoculant.
- G. Do not perform seeding during windy weather, or when the ground surface is frozen, wet or otherwise non-tillable. No seeding shall be performed during December through February unless otherwise permitted.
- H. When specified, provide seeding with mulch:
 - 1. Spread hay or straw mulch evenly over the seeded area at an approximate rate of 75 pounds per 1,000 square feet immediately following the seeding operations. This rate may be varied by the Engineer, depending on the texture and condition of the mulch material and the characteristics of the area seeded.

2. Hold hay or straw mulch in place by the use of a mulch binder applied at the approximate rate of 4 gallons per 1,000 square feet as required.
 3. Cover bridges, guardrails, signs and appurtenances, if the mulch binder is applied in such a way that it would come in contact with or discolor the structures.
 4. When wood fiber mulch is used, uniformly apply at the rate of 28 to 35 pounds per 1,000 square feet with hydraulic mulching equipment.
- I. Reseed as necessary.

3.02 SPRIGGING

- A. Lightly incorporate fertilizer into the soil for a depth 1/2" at the rate of:
1. 12 lbs. per 1,000 square feet for grade 0-20-20 or equivalent.
 2. 100 lbs. per 1,000 square feet for agricultural limestone.
- B. Perform sprigging during September-November or April-May and only when the soil is in tillable or workable condition.
- C. Do not set crowns during windy weather or when the ground surface is frozen.
- D. Set crowns as soon as preparation of the sprig bed has been completed.
- E. Set crowns at the rate of three sprigs per square yard by means of a tree-planting bar or equal.
- F. When specified, perform mulching before sprigging:
1. Spread mulch material evenly over the area to be planted at the rate of 100 lbs. per 1,000 square feet. This rate may be varied by the Engineer depending upon the texture and condition of the mulch material and the ground surface.
 2. Cover with a uniform layer of mulch so that 20 to 25 percent of the ground is visible. The mulch shall be loose enough to allow sunlight to penetrate and air to circulate slowly, but thick enough to partially shade the ground and to reduce erosion.

3. Hold the mulch in place with mulch binders applied at the rate directed by the Engineer, not to exceed 0.1 gallon per square yard, as required to hold the mulch in place.

3.03 SODDING

- A. Place sod at all locations shown on the Plans or where directed.
- B. Loosen the surface of the ground to be sodded to a depth of not less than one inch with a rake or other device.
- C. If necessary, sprinkle with water until saturated for a minimum depth of one inch and keep moist until the sod is placed.
- D. Immediately before placing the sod, fertilize the prepared surface uniformly at the rate of:
 1. 12 lbs. per 1,000 square feet for grade 10-10-10 or equivalent.
 2. 100 lbs. per 1,000 square feet for agricultural limestone.
- E. Place sod as soon as practical after removal from the point of origin, and keep in a moist condition during the interim.
- F. Carefully place, by hand, on the prepared ground surface with the edges in close contact and, as far as possible, in a position to break joints.
- G. Each strip of sod laid shall be fitted and pounded into place using 10 inch by 10 inch wood tramps, or other satisfactory implements.
- H. Immediately after placing, thoroughly wet and roll with an approved roller or hand-tamp as approved by the Engineer.
- I. On slopes of two to one or steeper, pinning or pegging may be required to hold the sod in place.

3.04 TOPSOIL

- A. Prepare landscape area to receive topsoil in close conformity to the lines and grades shown on the drawings or match with existing grades prior to line in installations.
- B. Place a 6" layer of topsoil over all areas disturbed by construction activities.
- C. Topsoil shall be free of rocks, sticks, roots, or frozen clods.

3.05 WATERING

- A. The Contractor is required to water in dry conditions to maintain proper moisture for growth of the grass until established.

END OF SECTION

SECTION 02528 CONCRETE CURBS, GUTTERS AND SIDEWALKS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Formwork complete with shoring, bracing and anchorage.
- B. Concrete reinforcement complete with required supports, spacers and related accessories.
- C. Cast-in-place concrete for curbs, gutters and sidewalks.
- D. Joint work

1.02 RELATED WORK

- A. Section 02110: Clearing and Grubbing
- B. Section 02221: Trenching, Backfilling, and Compaction
- C. Section 03001: Concrete Work

PART 2 PRODUCTS

2.01 Use Class "A" concrete as specified in Section 03001.

2.02 FORM MATERIALS

- A. Either wood or metal, free from warp with sufficient strength to resist the pressure of the concrete without springing, extending for the full depth of concrete.
- B. Use curved forms of proper radius on all radial sections and of acceptable design to Engineer.
- C. Use 1/8" thick metal templates between 10" section with:
 - 1. Width - same as curb, gutter or sidewalk.
 - 2. Depth - at least 1/4" more than curb, gutter or sidewalk depth.
 - 3. Lugs or other devices to hold templates in position and permit removal without causing damage to concrete.
- D. Use a metal strike-off template to shape the top surface of gutters or sidewalks.

2.03 JOINT MATERIALS

- A. 1/2" thick performed filler, unless otherwise specified.
- B. Cut to full cross-section of curb, gutter and/or sidewalk.
- C. True, even and of satisfactory appearance.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clear construction area in accordance with Section 02110.
- B. Compact sub-grade by tamping or rolling as specified in Section 02221.
- C. Thoroughly wet base or sub-grade prior to placing concrete.

3.02 FORMWORK

- A. Place forms so finished concrete will be true to line, grade and cross-section as shown on the drawings.
- B. Uniform section lengths - Maximum of 10 feet and minimum of 6 feet.
- C. Place joints at locations shown on drawings or in line with joints of adjoining construction, unless otherwise shown on drawings.
- D. Brace and stake forms to maintain vertical and horizontal alignment until their removal.
- E. Carefully set templates and leave in place until the concrete has set sufficiently to hold its shape. Remove templates while forms are still in place.
- F. Provide construction joints between new construction and all adjoining construction and around all utility appurtenances extending into sidewalks, unless otherwise specified.
- G. Clean and coat forms with light oil immediately before placing concrete.

3.03 CONCRETE PLACING

- A. Deposit the concrete on the base:
 - 1. When central or transit mixed concrete is used, place the mixture where it will require as little rehandling as possible.
 - 2. Continuously place between transverse joints without the use of intermediate bulkheads.
 - 3. Perform necessary hand spreading with shovels, or other approved tools.
 - 4. Do not allow workmen to walk in the freshly mixed concrete with boots or shoes coated with foreign substances.
- B. Consolidate concrete against and along the faces of all forms and along the full length and on both sides of all joint assemblies, by means of vibrators inserted in the concrete.
 - 1. Do not permit vibrators to come in contact with a joint assembly, the grade, or a side form.
 - 2. Do not operate the vibrator longer than 5 seconds in any one location.

3. Operate vibrators mounted on a machine only while in motion.
- C. Deposit concrete as near to expansion and contraction joints as possible without disturbing them, but do not dump from the discharge bucket or hopper onto a joint assembly unless the hopper is well centered on the joint assembly.
- D. Should any concrete materials fall on or be worked into the surface of a complete slab, remove immediately by approved methods.

3.04 FINISHING CONCRETE - GENERAL

- A. When necessary, strike-off concrete using transverse templates resting upon the side forms.
- B. Remove templates, then the forms when the concrete has set sufficiently to hold its shape.
- C. Finish surface with floats and straightedges, when required, to a smooth even finish.
- D. Round edges at templates and expansion joints with an edging tool of 1/4" radius.
- E. Remove all tool marks with a wetted brush or wooden float.
- F. Clean the top and ends of expansion joint materials and trim to slightly below the concrete surface.
- G. Remove forms, without exerting pressure on the concrete, at any time when such removal will not damage the concrete.
- H. Protect concrete work until finally accepted.
- I. Remedy damaged work, that has not been accepted, by removing and reconstructing each section that is damaged.

3.05 FINISHING CURBS AND GUTTERS

- A. No plastering will be permitted.
- B. Unless otherwise specified, the edges of the curb and gutter shall be rounded to a radius of 3/4".
- C. Finish the back of curbs not less than 3" below the top of backfill against the curb.
- D. Any exposed surface or surfaces against which some rigid type of construction is to be made shall be left smooth and uniform so as to permit free movement of the curb, gutter or combined curb and gutter.
- E. When the use of curb machines is permitted, finish as specified above except that contraction joints may be sawed a minimum depth of 1/4 the thickness of the section at intervals not less than 6 feet nor more than 10 feet in lieu of constructing the curbs in sections.
- F. Place weep holes or drainage openings through curbs as indicated on the Plans or as directed by the Engineer, with at least one-half cubic foot of coarse aggregate behind each opening.

3.06 FINISHING SIDEWALKS

- A. When the surface of the concrete is free from water and just before the concrete obtains its initial set, finish and sweep lightly with a broom in order to produce a sandy texture.
- B. The longitudinal surface variations shall be not more than 1/4" under a 12' straightedge, nor more than 1/8" on a 5' transverse section.
- C. The surface of the concrete shall be so finished as to drain completely at all times.
- D. Round the edges with an edging tool having a radius of 1/2".
- E. Divide the surface of sidewalks into blocks by use of a grooving tool.
 - 1. Space the grooves approximately 5' apart with the blocks rectangular unless otherwise ordered by the Engineer.
 - 2. Cut the grooves to a depth of not less than 1".
 - 3. Edge the grooves with an edging tool having a radius of 1/4".

4. Place grooves in median pavement in line with corresponding joints in adjoining construction or as directed by the Engineer.
- F. Unless otherwise indicated on the Plans, place marks or grooves at right angles to the center-line of driveways and approximately 8" apart.
1. These markings shall be between 1/8" and 1/4" in depth and shall be made with a suitable marking tool.
 2. A grooving tool, 6 to 8 inches in width, with multiple grooves for grooving alternate strips 8" apart, may be used.
 3. All marking edges shall be rounded satisfactorily.
- G. Do not place grooves in the surface of sidewalks reinforced for beam action where the full thickness of concrete is required for strength.
- H. Do not allow pedestrians, vehicles or loads upon concrete sidewalks until 12 hours after finishing concrete, or until the Engineer has determined that the concrete has attained sufficient strength for such loads.

END OF SECTION

SECTION 02605 SEPARATION OF PIPE UTILITIES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Location of piped utilities to separate water mains from sewer facilities.

1.02 RELATED WORK

- A. Section 02305: Boring and Jacking
- B. Appropriate Piped Utility Sections (2700 numbers)

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 SEWER RELATION TO WATER MAINS

- A. **Horizontal Separation:** Whenever possible, sewers should be laid at least 10 feet horizontally from any existing or proposed water main. The distance should be measured edge to edge. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if it is laid in a separate trench and if the elevation of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.
- B. **Vertical Separation:** Whenever sewers must cross under water mains, the sewer shall be laid at such elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied

to meet the above requirement, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the sewer shall be designed and constructed equal to the water main pipe and shall be pressure-tested to assure water-tightness.

- C. Do not install water mains or sewer facilities which pass through or contact each other.

3.02 CLEARANCE REQUIREMENTS FOR UNDERGROUND POWER

- A. Water lines are to be a minimum of 4' 0" from centerline of the nearest underground electric power line.
- B. Underground electric power cables are to be installed below all water lines whenever possible and have a minimum 12" vertical clearance.
- C. If electric lines are to be installed above water utilities, electric lines are to be encased in concrete and will be extended 2' 0" past the centerline on each side of the crossing. Maintain minimum 12" vertical clearance.
- D. If these distances cannot be met, refer to National Electric Safety Code rules 352C and 354 and obtain approval from owner.

END OF SECTION

SECTION 02713 WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Installation, testing and disinfecting of water lines and appurtenances.

1.02 RELATED WORK

- A. Section 02221: Trenching, Backfilling and Compaction
- B. Section 02300: Highway, Street, and Railroad Crossings
- C. Section 02605: Separation of Piped Utilities

PART 2 PRODUCTS

2.01 POLYVINYL CHLORIDE PIPE (PVC) AND FITTINGS

- A. Locate wire shall be provided on all installations. The locate wire shall be 12 AWG copper-clad carbon steel with 30 mils (minimum) of insulation. The external color shall be either white or yellow. The locate wire shall be brought to grade within a valve box or location station box at all “entry point locations” and all “exit point locations”. There is no maximum length or interval between the locate wire stations. If the locate line breaks or if it is not continuous, the Contractor shall, at the Contractors expense, provide soft-digs every 50 LF along the main to provide detailed as-built data. The soft dig data shall be recorded on the as-built drawings.
- B. For pipe diameters 4 inches and less unless called for in the Drawings provide PVC pipe meeting AWWA C-900 DR 14 or less where increased pressure dictates.

AWWA C-900 Pipe should meet the following requirements:

1. PVC 1120 pipe manufactured from virgin, National Sanitation Foundation (NSF) approved compounds meeting the requirements of ASTM D-1784.
2. Pressure rated based on Dimension Ratios (DR) and pressure classes (pressure classes are working pressure ratings):

<u>Dimension Ratio (DR)</u>	<u>Pressure Class (psi)</u>
14	305
3. Outside diameter equivalent to the same outside diameter of ductile iron pipe.
4. The minimum wall thickness of the bell, at any point, shall conform to the DR requirements of the pipe.
5. Furnish in standard laying lengths of twenty (20) feet.
6. Clearly mark with the manufacturer's name, nominal diameter, DR, PVC 1120, pressure class, AWWA C-900, and NSF approval seal.
7. PVC joints shall be sealed with a rubber ring and non-toxic lubricant provided by the pipe manufacturer as specified in ASTM D-3139 and ASTM F-477.
8. Gasket and pipe must be tested and approved for contact with potable water in accordance with ANSI/NSF 61 and NSF 14.

C. All remaining pipe diameters 4 inches and less not specified in the Drawings as AWWA C-900 DR 14 shall be SDR 21 or SDR 13.5 PVC. SDR 21 or SDR 13.5 PVC should meet the following requirements:

1. Pipe and fittings shall be made in accordance with ASTM D-2241 from a compound conforming to a cell classification of 12454 as defined by ASTM D-1784.
2. Pressure rated based on Dimension Ratios (DR) and pressure classes (pressure classes are working pressure ratings):

<u>Dimension Ratio (DR)</u>	<u>Pressure Class (psi)</u>
13.5	315
21	200
3. The minimum wall thickness of the bell, at any point, shall conform to the DR requirements of the pipe.
4. All PVC pipe and fittings shall be clearly marked with manufacturer's name, nominal diameter, SDR, ASTM D-2241, pressure rating, and NSF approval seal.

5. PVC joints shall be sealed with a rubber ring and non-toxic lubricant provided by the pipe manufacturer as specified in ASTM D-3139 and ASTM F-477.
6. Gasket and pipe must be tested and approved for contact with potable water in accordance with ANSI/NSF 61 and NSF 14.

2.02 DUCTILE IRON PIPE AND FITTINGS

- A. For pipe diameter 6 inches and larger unless called for in the Drawings provide Ductile Iron Pipe Pressure Class 350. Pipe and fittings shall also be lead free as defined in the "Reduction of Lead in Drinking Water Act", Public Law 111-380, when effective on January 4, 2014.
- B. Pipe:
 1. Manufactured in accordance with ANSI A-21.51-96 (AWWA C-151) and ANSI A-21.10-93 (AWWA C-110).
 2. A cement lining meeting the requirements of ANSI 21.4-95 (AWWA C-104).
 3. A minimum of 1 mil thick bituminous coating on the outside surface.
 4. Clearly mark with manufacturer's name, D.I. or Ductile, weight, class or nominal thickness, and casting period.
 5. Unless otherwise specified or shown on the plans, ductile iron pipe shall be pressure class 350 for all pipe sizes and laying conditions.
- C. Fittings:
 1. Fittings 4" - 24": Pressure rated at 350 psi.
 2. Fittings 30" - 36": Pressure rated at 250 psi.
 3. Joints meeting the requirements of ANSI A-21.11-95 (AWWA C-111).
 4. All concreted fittings shall be wrapped in plastic.
 5. A cement lining meeting the requirements of ANSI 21.4-95 (AWWA C 104).
 6. A minimum of 1 mil thick bituminous coating on the outside surface.

2.03 HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS

- A. Materials used for the manufacturer of polyethylene pipe and fittings shall be PE3408 high density polyethylene meeting cell classification 345464C per ASTM D3350; and meeting type III, Class B or Class C, Category 5, Grade P34 per ASTM D1248; and shall be listed in the name of the pipe and fitting manufacturer in PPI TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade rating of 1600 psi at 73 degrees per ASTM D2837. The manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.
- B. Polyethylene Pipe 4" through 12" shall conform to AWWA C906, DR-11, or less where increased pressure dictates, Ductile Iron Pipe Size and NSF 61 Standard. HDPE shall be manufactured in accordance with ASTM F714, Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter and shall be so marked. Each production lot of pipe shall be tested for melt index, density, % carbon, dimensions and either quick burst or ring tensile strength (equipment permitting).
- C. The pipe shall have permanent identification marked by co-extruding multiple equally spaced blue stripes on the pipe outside surface or by a solid blue colored pipe shell to indicate pipe carries potable water.
- D. Polyethylene fittings and custom fabrications shall be molded or fabricated by the pipe manufacturer or trained personnel. Butt fusion outlets shall be made to the same outside diameter, wall thickness and tolerances as the mating pipe. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe. Fabricated fittings must have the same working pressure as the mating pipe.
 - 1. Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings.
 - 2. Molded fittings shall be manufactured in accordance with ASTM D3261, Butt Head Fusion Polyethylene (PE) Plastic Pipe and Tubing and shall be so marked. Each Production lot of molded fittings shall be subjected to the test required under ASTM D3261.
- E. Polyethylene Mechanical Joint (MJ) Adapters to ductile iron piping shall be through a self-restraining, fusible adapter with or without an integral, internal stainless steel insert. Mechanical joint adapters shall be of the same SDR rating as the pipe. A separate, loose stainless steel type insert will only be allowed for pipe sizes 4" through 8".
- F. Services 2" and smaller shall include an integral shut-off valve and be Philmac Fuse-A-Corp fusible valve; or Central Plastics electro fusion saddle tapping tee

(use shell cutter to cut the HDPE or method approved by the City of Johnson City).

- G. Drilling fluids for HDPE operations shall be bentonite slurry. Contractor is responsible for obtaining, transporting and sorting any fluids, including water, to the work site.
- H. Disposal of fluids for HDPE operations is the responsibility of the contractor. Disposal of fluids shall be done in a manner that is in compliance with all permits and applicable federal, state and local environmental regulations. The bentonite slurry may be recycled for reuse in the hole opening operation or shall be hauled by the Contractor to an approved location or landfill for proper disposal. The Contractor shall thoroughly clean the entire area of any fluid residue upon completion of installation and replace any and all plants and sod damaged, discolored or stained by drilling fluid.

2.04 MAIN LINE METERS

- A. Propeller type with 125 lb. Flanged joints.
- B. Shall be Neptune Model T10 or equal.

2.05 SERVICE PIPE:

- A. Copper Pipe:
 - 1. Seamless copper tubing meeting the requirements of ASTM B-88, Type K.
 - 2. Contain not less than 99.90% copper and not more than 0.04% phosphorous.
 - 3. Suitable for use with a working water pressure of 160 psi.
 - 4. 3/4 inch nominal diameter unless otherwise specified or shown on the plans.
 - 5. Service pipe shall be used to connect the corporation stop with the meter yoke. Use the minimum length required to make a straight line connection including a gooseneck.
 - 6. Shall be manufactured in USA.

2.06 WATER SERVICE ASSEMBLIES

- A. All service assembly components must be lead free as defined in the "Reduction of Lead in Drinking Water Act", Public Law 111-380, when effective on January 4, 2014.

- B. Water Meters:
 - 1. AWWA C-700
 - 2. 5/8" x 3/4" unless otherwise specified or shown on the plans.
 - 3. Frost proof with a cast bronze casing and a hinged cover.
 - 4. Direct reading register, in gallons, unless otherwise specified.
 - 5. Disc or piston operated with magnetic drive.
 - 6. A suitable non-corrosive strainer located over the inlet to the measuring chamber.
 - 7. The name of the manufacturer cast in the lid of the register box and the meter serial number imprinted thereon.
 - 8. Shall be manufactured by Neptune only.

- C. Water Main Connections:
 - 1. Tap water mains in the upper half of the pipe at a 45 degree angle or provide brass tapped couplings with AWWA threads.
 - 2. Do not exceed the pipe manufacturer's recommended maximum tap size.
 - 3. Use service clamps on all taps for PVC pipe.

- D. Corporation Stops:
 - 1. AWWA C-800.
 - 2. Water tight and individually tested for leaks.
 - 3. Waterway diameter approximately equal to the nominal size of the stop.
 - 4. Coat or cap all threads for protection prior to installation.
 - 5. Shall be manufactured by Ford or approved equal, shall be manufactured in USA.

- E. Meter Yokes:
 - 1. Copper tubing with an integral brace and meter stop.
 - 2. Provide with outlets designed for the use of polyethylene or copper service pipe.

3. Shall be manufactured by Ford or approved equal, shall be manufactured in USA.
- F. Service Clamps:
1. Bronze with neoprene gasket and double straps.
 2. Shall be manufactured by Mueller, Rockwell, or Kennedy only.
- G. Meter Boxes:
1. Rectangular pre-cast concrete, cast iron or plastic.
 2. Pre-cast concrete and cast iron meter boxes shall have a cast iron lid.
 3. Depth of the meter box not less than 18 inches.
 4. Of sufficient size to facilitate easy installation and removal of the water meter.
 5. Where service assemblies include a pressure reducing valve, sufficiently sized for installation of the pressure reducing valve in the meter box.
- G. Shall be NDS with solid cast iron overlapping cover or approved equal, shall be manufactured in USA. Pack Joint Coupling (MIP x SJ Adapter)
1. All brass conforming to AWWA Standard C800 (ASTM B-62 and ASTM 584, UNS NO C83600 - 85-5-5-5).
 2. Body design provides hexagonal wrench flats for proper installation.

2.07 VALVES AND VALVE BOXES

A. 2" Gate Valves:

1. AWWA C-515, as applicable.
2. Valve operating stem shall be non-rising and manganese bronze only.
3. All cast iron surfaces of the body and bonnet shall be completely coated with a corrosion resistant coating.
4. 2" square wrench nut for operation of the valve.
5. Minimum design working water pressure of 200 psi for valves, unless otherwise specified or shown on the Plans.
6. Valves shall be threaded connection.
7. Bonnet or body markings: Manufacturer's name, year of casting, size, pressure rating, and OPEN with direction.
8. Open by counter-clockwise operation.
9. Valves shall be of domestic manufacture only. Approved Products: Kennedy Valve, M&H Valve, or Mueller Valve, Stockham Valve and U.S. Pipe Valve.

B. 4" – 12" Gate Valves:

1. AWWA C-515.
2. Of iron body, bronze mounted, double disc, parallel seat, non-rising stem type.
3. Stuffing boxes: O-ring seal type with two (2) rings in the stem located above the thrust collar.
4. 2" square wrench nut for operation of the valve.
5. Minimum design working water pressure of 200 psi for valves with diameters 2"-54", unless otherwise specified or shown on the Plans.
6. Joints: ANSI A-21.11 (AWWA C-111).
7. Bonnet or body markings: Manufacturer's name, year of casting, size, pressure rating, and OPEN with direction.
8. Open by counter-clockwise operation.
9. Shall be manufactured by American Flow Control, Kennedy, M&H, Mueller, or U.S. Pipe only.

C. Butterfly Valves:

1. All valves 16" and larger shall be of the butterfly type.
2. AWWA C-504.
3. Cast iron body, with ends for mechanical joints, rubber molded-in-place seat design type.
4. Cast markings: valve size, manufacturer's name, class, direction of opening, and the year of casting.
5. Class 250, suitable for working water pressure of 250 psi unless otherwise specified or shown on the plans.
6. Open by counter-clockwise operation.
7. Valves shall be of the bury type with side operated spur gear box with a typical AWWA 2" operating nut.
8. Pratt "Groundhog" or approved equal, shall be manufactured in USA.

D. Main Line Pressure Reducing Valves:

1. The reducing valve shall function to maintain a uniform valve downstream pressure as pre-adjusted on the control pilot hand-wheel or adjusting screw.
2. The valve piston shall be guided on its outside diameter by long stroke stationary V-ports which shall be downstream of the seating surface to minimize the consequences of throttling. Throttling shall be done by the valve V-ports and not the valve seating surfaces.
3. The valve shall be capable of operating in any position and shall incorporate only one flange cover at the valve top from which all internal parts shall be accessible.
4. The valve body shall be of cast iron ASTM-126 with flanges conforming to the latest ANSI Standards. The valve shall be extra heavy construction throughout. The valve interior trim shall be bronze B-62 as well as the main valve operation.
5. The valve seals shall be easily renewable. The valve shall operate by a pressure differential piston design; no diaphragm shall be permitted within the main valve body.

6. All controls and piping shall be non-corrosive construction.
 7. A visual valve position indicator shall be provided for observing the valve piston position at any time.
 8. The operating range shall be from 175 psi to 100 psi.
 9. Golden Anderson or approved equal, shall be manufactured in USA.
- E. Valve Boxes:
1. Cast iron, 2 or 3 piece, screw type with shaft diameter of not less than 5".
 2. Heavy roadway type equipped with a cover containing the word "WATER" in raised letters on the top.
 3. Base of such size as to permit its installation without allowing it to come in contact with either the valve or the pipe.
 4. Valve boxes for lines 12" and larger shall be 5¼" shaft, 2 piece, screw-type, adjustable valve box with square drop-in lid with 1-1½" skirt, as manufactured by Bingham & Taylor, or equal.
 5. Valve boxes for lines smaller than 12" shall be 5¼" shaft, screw-type, series 6850 as manufactured by Tyler/Union, or equal.

2.08 COMBINATION AIR RELEASE ASSEMBLIES

- A. Shall be lead free as defined in "Reduction of Lead in Drinking Water Act", Public Law 111-380, when effective on Jan 4, 2014.
- B. Furnish in 1" nominal diameter for 8" mains and smaller and in 2" nominal diameter for 10" mains and larger, unless otherwise specified or shown on the Plans.
- C. Combination air release assemblies shall consist of:
 1. Double strap, bronze service clamp with neoprene gasket (for PVC lines).
 2. Brass pipe of the nominal diameter required by the main size.

3. Red brass corporation stop.
 4. Brass elbow.
 5. Gate valve.
 6. An air and vacuum valve coupled with an air release valve. Non-Metallic body shall be fabricated from fiberglass reinforced nylon. Inlet sizes through 2 inches shall be screwed (NPT). Pipe sizes 3" and above shall have flanged inlets. A protective hood or cowl shall be installed on the outlet of flanged-bodied valves.
 7. Non-metallic floats shall be foamed polyethylene with stainless steel type 316 fasteners.
 8. Rolling seals shall be furnished for non-metallic valves 2" and below.
 9. Suitable for use in mains having a pressure of 250 psi.
 10. Shall be single body.
 11. Shall be manufactured by ARI, Apco, Empire, or equal, shall be manufactured in USA.
- D. Shall be installed in a 2" large meter box with overlapping bolt-down solid plastic cover with cast iron reader cover.
- E. Place crushed stone from the top of the main to 12" below the bottom of the main.

2.09 FIRE HYDRANTS

- A. Fire Hydrants:
1. AWWA C-502.
 2. Cast iron bodies, fully bronze mounted, designed for operation at a working water pressure of 150 psi.
 3. Furnish with two 2-1/2" threaded brass hose nozzles and one threaded brass pumper nozzle.

4. Compression type main valve 4-1/2" in diameter faced with a suitable yielding material such as rubber, leather, or balata.
5. So designed that, when it is installed, no excavation is required to remove the main valve or the movable parts of the drain valve.
6. Inside diameter of barrel: at least 120 percent of the hydrant valve size.
7. Inlet connection: minimum of 6" mechanical joint on all lines, unless otherwise specified or shown on the plans.
8. Equipped with safety flange located not more than 2" above ground and a two piece shaft break-away assembly.
9. Open on counter-clockwise operation, unless otherwise specified.
10. Shop paint and mark in accordance with AWWA C-502.
11. Cast markings: manufacturer's name, size of the main valve, year of manufacture, and direction of opening.
12. Field touch-up, if the surface has been marred, with paint supplied by the manufacturer of the same color and type as that used during shop painting.
13. Shall be Kennedy Guardian K81-D as manufactured by the Kennedy Valve Company, or American Darling Mark 73-5 as manufactured by American Flow Control.

PART 3 EXECUTION

3.01 PREPARATION

- A. Prior to laying pipe, prepare suitable bedding according to Section 02221.
- B. Before placing pipe in the trench, field inspect for cracks or other defects; remove defective pipe from the construction site.

- C. Swab the interior of the pipe to remove all undesirable material.
- D. Prepare the bell end and remove undesirable material from the gasket and gasket recess.
- E. The Contractor shall provide any environmental protection necessary to contain any hydraulic or drilling fluids and shall be put in place, including berms, liners, turbidity curtains and other measures during drilling for HDPE. The Contractor shall adhere to all applicable environmental regulations including environmental conditions stated in local, state and federal permits.
- F. Prior to drilling, the Contractor shall utilize all verified location information to determine the drill pathway.

3.02 *INSTALLING DIP/PVC WATER LINES*

- A. Lay all pipe in a straight line on a uniform grade with at least 36" of cover measured from the top of the pipe.
- B. After applying gasket lubricant, take extreme care to keep the spigot end from contacting the ground.
- C. Hone the pipe with suitable tools or equipment.
- D. Closely follow the manufacturer's instruction in laying and joining pipe.
- E. Cut pipe for inserting valves, fittings, etc. in a neat and workmanlike manner without damaging the pipe so as to leave a smooth end at right angles to the axis of the pipe.
- F. All pipe ends shall be sealed at the end of the work day. When work is resumed the next day and seals removed the first joint of pipe shall be inspected for damages or debris.
- G. If dirt enters the pipe it shall be removed and the interior of the pipe surface swabbed with a 1% to 5% hypochlorite solution. If, in the opinion of the purchaser, the dirt remaining in the pipe will not be removed using the flushing operation, then the interior of the pipe shall be cleaned by mechanical means in conjunction with the application of a 1% hypochlorite disinfection solution.

- H. During construction calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500 feet intervals. The quantity of granules shall be as shown:

PIPE DIAMTERS INCHES	CALCIUM HYPOCHLORITE GRANULES OUNCES
4	1.7
6	3.8
8	6.7
10	10.5
12	15.1
14 AND LARGER	D2 X 15.1

(D IS THE INSIDE PIPE DIAMETER IN FEET)

- I. Pipe is not to be strung out in mud unless the ends are sealed.
- J. Locate waterlines in relation to other piped utilities in accordance with Section 02605.

3.03 HDPE DRILLING PROCEDURES

- A. The Contractor shall provide and maintain instrumentation necessary to accurately locate the pilot hole (both horizontally and vertically), measure pilot string torsional and axial and measure the drilling fluid discharge rate and pressure. The City of Johnson City shall have access to the instrumentation and reading at all times during the operation.
- B. The pilot hole shall be drilled along the path shown on the plans or as directed by the City of Johnson City representative in the field. Unless approved otherwise, the pilot hole tolerances shall be as follows:
 1. Elevation as shown on plans
 2. Alignment equal to +/- 5 feet and within 3 feet of right-of-way or easement boundary.
 3. Curve radius shall be no less than 80% maximum bending radius as recommended by the pipe manufacturer. In no case shall the bending radius be less than 30 pipe diameters, unless approved otherwise by the City of Johnson City.

4. The exact pilot hole entry point location shall be within +/- 5 feet of the location shown on the drawing or as directed by the City of Johnson City representative in the field.
5. The exit point location shall be within +/- 5 feet of the location shown on the drawing or as directed by the City of Johnson City representative in the field.
6. If not noted on the plans, 6" HDPE and smaller shall be installed with a depth of 2.5 – 5 feet and 8" HDPE pipe through 12" pipe shall be installed with a depth of 2.5 – 6 feet unless it is required to install the pipe deeper due to utility conflicts. Where utilities cross under roads, the depth of cover shall comply with applicable road permits.

3.04 HDPE PULL BACK OPERATIONS

- A. After successfully reaming the bore hole the required diameter, the Contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel and reamer to compact the bore hole walls. Once the pull-back operations have commenced, operations must continue without interruption until the pipe is completely pulled into the bore hole. During pull-back operations, the Contractor will not apply more than the maximum safe pull pressure at any time. Maximum allowable tensile force imposed on the pull section shall be equal to 80% of the pipe manufacturer's safety pull (or tensile) strength.
 1. Torsional stress shall be minimized by using a swivel to connect a pull section to the reaming assembly.
 2. The pull-back section of the pipeline shall be supported during pull-back operations so that it moves freely and the pipe is not damaged.
 3. External pressures shall be minimized during installation of the pull-back section in the reamed hole. Damaged pipe resulting from external pressure shall be replaced at no cost to the City of Johnson City.
 4. Buoyancy modifications shall be at the discretion of the Contractor and shall be approved by the City of Johnson City representative. The Contractor shall be responsible for any damage to the pull section resulting from such modifications.
 5. In the event that the pipe does become stuck, the Contractor will cease pulling operations to allow for any potential hydro-lock to subside. After subsidence, pulling operations may be restarted. If the pipe remains stuck, the Contractor will notify the City of Johnson City representative to discussion of options and then work will proceed accordingly.

6. The Contractor shall provide rated break-away link for each material and pipe sizes(s) required for the project.

3.05 HDPE PIPE ASSEMBLY

- A. Joints between plain end pipes and fittings shall be made by butt fusion when possible. Electro fusion welding may also be used to complete when the location is not accessible to butt fusion welding equipment. External and internal beads shall not be removed unless approved by the City of Johnson City.
- B. Pipe shall be welded/fused together in one length, if space permits. Pipe may be placed on pipe rollers before pulling into bore hole to minimize damage to the pipe. It is critical that all original oxidized pipe surfaces be removed in order for the fusion to take place. The scrapping process requires that approximately 0.10" of the outer "skin" be removed in order to penetrate the oxidation and contamination barrier. Oxidized pipe simply will not bond.
- C. Mechanical joints and flange connections shall be installed in accordance with the manufacturer's recommended procedures. Flange faces shall be centered and aligned to each other before assembling and tightening the bolts. In no case shall the flange bolts be used to draw the flanges into alignment. Bolt threads shall be lubricated and flat washers shall be fitted under the flange nuts. Bolts shall be evenly tightened according to the tightening pattern and torque recommendations of the manufacturer. At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the manufacturer. The final tightening torque shall be 100 ft-lbs or less as recommended by the manufacturer.
- D. Locate wire shall be provided on all installations. The locate wire shall be 12 AWG copper-clad carbon steel with 30 mils (minimum) of insulation. The external color shall be either white or yellow. The locate wire shall be brought to grade within a valve box or location station box at all "entry point locations" and all "exit point locations". There is no maximum length or interval between the locate wire stations. If the locate line breaks or if it is not continuous, the Contractor shall, at the Contractor's expense, provide soft-digs every 50 LF along the main to provide detailed as-built data. The soft dig data shall be recorded on the as-built drawings.
- F. Cuts or gouges that reduce the wall thickness by more than 10% is not acceptable and must be cut out and discarded.
- G. When requested by the City of Johnson City representative, butt fusion testing will be performed. The test fusion shall be allowed to cool completely and then fusion test straps shall be cut out. The test strap shall be 12" (minimum) or 30

times the wall thickness in length with the fusion in the center and 1" (minimum) or 1.5 times the wall thickness in width. Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new fusion shall be made, cooled and completely retested.

- H. Cap pipe at the end of the working day or after pull-back operations to prevent foreign materials from entering the pipe.

3.03 INSTALLING APPURTENANCES

- A. Securely plug open ends of pipe at the close of each work day and during temporary discontinuance of pipe laying.
- B. Set all valves, fittings, hydrants, and other specials in a neat workmanlike manner.
- C. Use thrust blocks as shown on the Plans, when suitable undisturbed soil is present in trench walls. Where suitable soil is not present or where called for in the Drawings use ductile cast iron mechanical joint retainer glands installed in accordance with manufacturers directions.
- D. Erect hydrants to stand plumb with the pumper nozzle facing the road.
- E. Effect drainage of hydrants by using 6 cubic feet of gravel.
- F. Close dead ends with cast iron plugs or caps and equip with blow-off assemblies, where shown on the drawings.

3.04 HIGHWAY AND RAILROAD CROSSINGS

- A. Perform highway crossings by the open cut method, unless otherwise shown on the drawings or required by the appropriate authorities.
- B. Boring and jacking of crossings, if necessary, will be performed and paid for in accordance with Sections 01150 and 02305.

3.05 CONCRETE ENCASEMENT

- A. Concrete encase water line as shown in the Drawings or where directed to do so by the Engineer.

3.06 WATER LINE PRESSURE TESTS

- A. After the pipe has been laid, subject all newly laid pipe or any valved section thereof to a hydrostatic pressure test in accordance with AWWA C600. When possible, conduct test on pipe lengths of less than 1000' or where this is not possible from one valve to the next closest valve.
- B. Pipe should be properly restrained. Insure that all concrete thrust blocks are properly cured.
- C. Contractor shall provide all necessary testing equipment to complete required testing. Contractor shall perform all testing which will be observed by the Owners field representative.
- D. Test pressures shall:
 - 1. Not be less than 1.5 times the working pressure at the highest point along the test section (150 psi minimum and 200 psi maximum).
 - 2. Not exceed the pipe or thrust restraint design pressures.
 - 3. Be of at least 2-hour duration.
 - 4. Not vary by more than ± 5 psi.
 - 5. Not exceed twice the rated pressure of closed valves or hydrants included in the test section.
 - 6. Not exceed the rated pressure of resilient-seated butterfly valves.
- E. Pressurization:
 - 1. Slowly fill each valved section of pipe with water.
 - 2. Apply the specified test pressure, based on the elevation of the lowest point of the line or section under test and correct to the elevation of the test gauge by means of a pump connected to the pipe in a manner satisfactory to the Owner.
- E. Air Removal:

1. Before applying the specified test pressure, expel air completely from the pipe, valves, and hydrants.
2. If permanent air vents are not located at all high points, install corporation cocks at such points to expel air as the line is filled with water.
3. After all the air has been expelled, close the corporation cocks and apply the test pressure.
4. At the conclusion of the pressure test, remove the corporation cocks and plug or leave in place at the discretion of the Owner.

F. Examination:

1. Carefully examine all exposed pipe, fittings, valves, hydrants, and joints.
2. Repair or replace any damaged or defective pipe, fittings, valve, or hydrants, that are discovered with sound material and repeat the test until it is satisfactory to the Owner.

3.07 WATERLINE LEAKAGE TESTS

- A. Concurrently conduct a leakage test with the pressure test in accordance with AWWA C600.
- B. Leakage Defined: the quantity of water that must be supplied into the newly laid pipe to maintain the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
- C. Allowable Leakage:
 1. Determine allowable leakage by:

$$L = \frac{ND(P)^{1/2}}{7400}$$

Where L is the allowable leakage, in gallons per hour; N is the number of joints in the tested pipeline; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in psi.
 2. Allow leakage at various pressures:
 Allowable Leakage Per 1000 ft. of Pipeline*

Ave. Test Pressure	Allowable Leakage Per 1000 ft. of Pipeline (Gallons per Hour)																
	Nominal Pipe Diameter - Inches																
	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	52
450	0.32	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350	0.28	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300	0.26	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275	0.25	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250	0.24	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225	0.23	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200	0.21	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175	0.20	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150	0.19	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.84	4.41	4.97
125	0.17	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100	0.15	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

*For Mechanical or push-on joint pipe with 18-ft. nominal lengths. To obtain the recommended allowable leakage for pipe with 20-ft. nominal lengths, multiply the leakage calculated from the above table by 0.9. If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

3. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.078 gal/hr/in. of nominal valve size shall be allowed.
4. When hydrants are in the test section, test against the closed hydrant.

3.08 ACCEPTANCE OF INSTALLATION

- A. For acceptance, all waterlines must be inspected, pressure tested, disinfected, flushed and pass a bacterial test.
- B. Inspection: Waterlines shall be inspected by a City of Johnson City Inspector for materials and installation methods.
- C. Pressure Testing: If any test of pipe laid shows leakage greater than that specified in 3.07 of this section or the pressure exceeds the beginning test pressure by ± 5 psi as specified in 3.06 of this section, the pipe is considered failed and will not be accepted. Contractor should locate and repair the defective material until the leakage and pressure tests are within the specified allowance. Repair all visible leaks regardless of the amount of leakage.
- D. Flushing: Waterlines are to be flushed at a flow rate to achieve a velocity of 3 feet per second.

3.09 CLEANING AND DISINFECTION OF WATER LINES

- A. Waterline disinfection shall be in accordance with AWWA C651.
- B. For disinfection, use only Sodium Hypochlorite or Calcium Hypochlorite meeting ANSI/AWWA B300 and manufactured expressly for the disinfection of water lines.
- C. Flush water lines clean prior to disinfecting.
- D. The main shall be filled with water at the rate to ensure the water within the main will flow at a velocity no greater than 1 ft/second.
 - 1. Use chlorine disinfecting agent applied to produce a 50 ppm dosage.
 - 2. Allow water to escape from the ends of all lines to cause dispersion of the chlorine solution into all parts of the system.
 - 3. Operate all valves and hydrants during the time disinfection is occurring.
 - 4. Retain the chlorine solution in the lines for a period of 48 hours.
 - 5. At the end of the 48 hour period, the residual chlorine must be a minimum of 25 ppm. Otherwise, repeat the disinfecting procedure again.

6. Flush the waterline.
- E. After the applicable retention time, heavily chlorinated water should not remain in the line. In order to prevent damage to the pipe lining or to prevent corrosion damage to the pipe, the chlorinated water shall be flushed from the main until the chlorine measurements show that the concentration in the water leaving the main is no higher than the generally prevailing in the distribution system or that is acceptable for domestic use.
 - F. The environment to which the chlorinated water is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will cause damage to the environment, then field dechlorination shall be performed in accordance with AWWA C655.

3.10 BACTERIAL SAMPLING

- A. After flushing with potable water, waterlines are to be tested for the presence of coliform bacteria in accordance with AWWA C651 by the City of Johnson City Water and Sewer Services Department by one of the two following procedures:
 - a. Two (2) sets of samples will be collected 15 minutes apart after a 16 hr holding period. Water should be allowed to run continuously from the sampling taps between samples.
 - b. One set of samples will be collected. After a 16 hour period, the second sample shall be collected.
- B. Collect samples for bacteriological analysis at the beginning, at the end, and from each branch. If the line exceeds 1200 feet additional samples are collected every 1200 ft of the new main and each branch. If the same is acceptable, the lines may be connected to the system. Otherwise repeat the disinfecting procedure until acceptable samples are obtained.

3.11 WATER SERVICE CONNECTIONS

- A. The Contractor shall give the Owner a week notice before the water service is to be turned off to make to make cuts to the existing waterline or to make customer tie-overs. This notice is required to give us time to discover cut-off valves in the surrounding area and to notify customers of an interruption in service.

END OF SECTION

SECTION 03001 CONCRETE WORK

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Formwork, complete with shoring, bracing and anchorage.
- B. Concrete reinforcing, complete with supports, spacers and accessories.
- C. Cast-in-place Concrete.

1.02 RELATED WORK

- A. Section 02110: Clearing and Grubbing
- B. Section 02215: Base and Subgrade Treatment

PART 2 PRODUCTS

2.01 AGGREGATE MATERIALS

- A. Fine Aggregate: Natural sand or other inert materials with similar characteristics conforming to AASHTO M-6 with the following exceptions:
 - 1. Freeze-thaw tests for soundness will not be required.
 - 2. Wash fine aggregates in the processing operations.
 - 3. Process limestone or dolomite from material which has been scalped to remove quarry fines.
 - 4. The material from which the fine aggregate is processed shall have a maximum wear or 40% by the Los Angeles test.

5. Deleterious substances shall not exceed 0.5% by weight for clay lumps, coal and lignite and 3.0% for material passing the No. 200 sieve and other deleterious substances.
6. Well graded from coarse to fine and, when tested by means of laboratory sieves, conforming to:

Sieve Size	Total Percent Passing by Weight
3/8 inch	100
No. 4	95-100
No. 16	60-90
No. 50	10-30
No. 100	0-10
No. 200	0-3

- B. Coarse Aggregate: Crushed Stone, crushed slab, gravel, chert, or a combination thereof, or other inert materials with similar characteristics, having hard strong durable pieces free from adherent coatings conforming for AASHTO-M-43, except as specified otherwise.

1. Graded to standard sizes between the limits specified conforming to the gradation requirements set forth in the following table:

Sizes of Coarse Aggregate AASHTO M-43

Size Number	Nominal Size Square Openings (1)	Amounts Finer Than Each Laboratory Sieve (Square Openings), Percentage By Weight															
		4	3 ½	3	2 ½	2	1 ½	1	¾	½	⅜	No.4	No.8	No.16	No.50	No.100	
1	3 ½ to 1 ½	100	90-100		25-60		0-15		0-5								
2	2 ½ to 1 ½			100	90-100	35-70	0-15		0-5								
24	2 ½ to ¾			100	90-100		25-60		0-10	0-5							
3	2 to 1				100	90-100	35-70	0-15		0-5							
357	2 to No. 4				100	95-100		35-70		10-30		0-5					
4	1 ½ to ¾				100	90-100	20-55	0-15		0-5							
467	1 ½ to No. 4				100	95-100		35-70		10-30		0-5					
5	1 to 1 ½					100	90-100	20-55	0-10	0-5							
56	1 to ¾					100	90-100	40-75	15-35	0-15	0-5						
57	1 to No. 4					100	95-100		25-60		0-10	0-5					
6	¾ to ¾					100	90-100	20-55	0-15	0-5							
67	¾ to No. 4					100	90-100		20-55	0-10	0-5						
68	¾ to No. 8					100	90-100		30-65	5-25	0-10	0-5					
7	½ to No. 4						100	90-100	40-70	0-15	0-5						
78	½ to No. 8						100	90-100	40-75	5-25	0-10	0-5					
8	¾ to No. 8							100	85-100	10-30	0-10	0-5					
89	¾ to No. 16							100	90-100	20-55	5-30	0-10	0-5				
9	No. 4 to No. 16								100	85-100	10-40	0-10	0-5				
10	No. 4 to 0 (2)									100	85-100						10-0

- (1) In inches, except where otherwise indicated. Numbered sieves are those of the United States Standard Sieve Series.
- (2) Where Size No. 10 (Screening) is specified in asphalt pavement design the percent passing the No. 4 sieve shall be 90-100 and the percent passing the No. 200 sieve shall be from 5-16.

2. Furnish coarse aggregate for concrete base and pavement in two sizes: no. 4 and No. 67. The two sizes shall be manufactured to produce Size No. 467, when combined in the proper proportions at the batching plant.
3. Coarse aggregate for structural concrete shall be Size No. 57 or Size No. 67, as specified or directed.
4. Coarse aggregate for concrete curbing placed by machine-extrusion shall be Size No. 7 or 78.

5. Conform to AASHTO M-80, except that the amount of deleterious substances shall not exceed the following limits:

	Maximum Percent by Weight
a. Soft or non-durable fragments (fragments which are structurally weak, such as shale, soft sandstone, limonite concretions, gypsum, weathered schist, or cemented gravel)	3.0
b. Coal or lignite	1.0
c. Clay lumps	0.25
d. Material passing the No. 200 sieve	0.75
e. Thin or elongated pieces (length greater than five (5) times average thickness)	10.0
f. Other local deleterious substances	1.0
g. Items a, b, c, d, and f, combined shall not exceed	5.0

2.02 CEMENT

- A. Use portland cement unless otherwise specified.
- B. Portland Cement: AASHTO M-85 or ASTM C-150
- C. Portland Blast Furnace Slag Cement: AASHTO M-151 or ASTM C-205

2.03 WATER

- A. Either potable or reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter, sewage or other injurious foreign matter. Test water not known to be potable in accordance with AASHTO T-26.

2.04 CHEMICAL ADDITIVES:

- A. Conform to AASHTO M-194, ASTM C-494, ASTM C-260, and AASHTO M-154 covering the following 6 types:

Type A - Water reducing admixtures

Type B - Retarding admixtures

Type C - Accelerating admixtures

Type D - Water reducing and retarding admixtures

Type E - Water reducing and accelerating admixtures

2.05 AIR - ENTRAINING ADMIXTURES

- A. ASTM C-260, CSA A-23, or AASHTO M-154.

2.06 CONCRETE PROPORTIONING

- A. Base Proportioning on a predetermined cement content.
- B. Adjust the quantity of water to meet slump requirements, not exceeding the maximum allowed.
- C. Unless otherwise specified, air entrainment shall be 5% with a tolerance of plus 3% or minus 2%.
- D. Submit a mix design to Engineer for approval prior to commencing work.
- E. Collect compression test specimens using ASTM C-31 or AASHTO T-23.
- F. Test compression strength specimens using ASTM C-39 or AASHTO T-22.
- G. Test slump using ASTM C-143 or AASHTO T-119.

2.07 CONCRETE CLASSIFICATIONS

- A. Class A Concrete (Structures): Unless otherwise specified and shown on the Plans, all concrete shall be Class A.
 - 1. Fine Aggregate: Proportion by dry weight of fine to coarse aggregates between 30-45%.
 - 2. Coarse Aggregates: Sizes as follows:
 - Size No. 57 - Structural Concrete
 - Size No. 57 or No. 67 - Prestressed and precast concrete
 - Size No. 7 or No. 78 - Extruded concrete curbs
 - 3. Minimum Compressive Strength: 28 day, 4000 psi, average any 3 cylinders.

4. Slump: 1 to 3 inches for mass concrete and heavy reinforced section; 2 to 4 inches for slabs, columns, girders, walls, etc. Vary consistency to meet job requirements, provided there is no increase in the maximum water-cement ratio specified in the mix design.
 5. Mixing Water: Deduct the moisture content of the aggregate from the amount of mixing water required.
- B. Class "P" Concrete (Base and Pavement):
1. Fine Aggregate: Do not use sand manufactured from limestone for traffic lane pavements.
 2. Coarse Aggregate: Size No. 67.
 3. Minimum Compressive Strength: 14 day, 3500 psi, average of any 3 cylinders.
 4. Slump: ½ - 1 ½ inches, workable consistency.
 5. Mixing Water: Include surface moisture but not moisture absorbed by the aggregate.
- C. Class B1 Concrete: Use for anchors, kickers, encasement for pipelines, subfoundations, mass footings, and fill, unless otherwise specified.
1. Fine Aggregate: Proportion by dry weight of fine to coarse aggregates between 30-45%. Test for potential alkali reactivity per ASTM C-289-71. Use natural river sand or specially approved manufactured sand, only.
 2. Coarse Aggregate: Size No. 57.
 3. Minimum Cement Content: 5.0 bags (470 lbs.) per cubic yard.
 4. Minimum Compressive Strength: 28 day, 2500 psi, average of any 3 cylinders.
 5. Slump: 5 to 8 inches for pipe encasements and 2 to 4 inches in subfoundations and other specified areas.
 6. Mixing Water: Maximum amount of water per 94 lb. Bag of Portland cement shall be 6.5 gallons. Deduct the moisture content of the aggregate from the amount of water required.

2.08 CONCRETE MIXING

- A. Obtain approval of all equipment prior to commencement of concrete placing operations.

- B. Mix and handle concrete in accordance with the general requirements of the TDOT.
- C. Give Engineer free access to the mixing site for inspection of equipment and mixing operations.
- D. Check and compensate for, if applicable, moisture content of aggregates prior to mixing.
- E. Mix batches only in quantities required for immediate use.
- F. Remove from the project site, all concrete reaching the site in a preset conditions or which fails slump requirements.

2.09 CONCRETE CURING MATERIALS

- A. Cure all concrete surfaces not protected by forms by keeping the surface moist or by the application of a membrane-forming curing compound.
- B. Initially, wet cure for a period of at least (24) hours. During the initial curing period, keep the surface moist and protected by burlap mats or other approved materials.
- C. Water: Water used in curing Portland cement concrete shall not contain any substances which will damage the surface of the concrete.
- D. Sand and Earth: Free of stones or other materials which will damage the surface of the concrete.
- E. Liquid Membrane-Forming Compounds: AASHTO M-148.
- F. Polyethylene Sheeting: AASHTO M-171.
- G. Burlap: AASHTO M-182, Class 3 or 4.
- H. Straw: Reasonably clean and free of any material that will damage the surface of the concrete.

2.10 EXPANSION AND CONSTRUCTION JOINTS

- A. Performed Bituminous Fillers: AASHTO M-33.
- B. Hot-Poured Elastic Type: AASHTO M-173
- C. Performed Elastomeric Compression Joint Seals: AASHTO M-260.

2.11 REINFORCEMENT STEEL

A. Bar Reinforcement for Concrete Structures:

- 1. Steel bars for reinforcement of concrete structures shall be billet steel bars conforming to the requirements of ASTM A-615, grade 40 or 60.
- 2. Reinforcing bars shall be deformed and shall have minimum section areas shown in the following table.

Sizes and Areas of Reinforcing Bars
Dimensions are for Round Sections

Bar Designation Number (a)	Nominal Diameter (Inches)	Cross-Sectional Area (Sq. In.)	Perimeter (Inches)	Weight (Pounds Per Ft.)	Notes
2	0.250	0.05	0.786	0.167	(b)
3	0.375	0.11	1.178	0.376	
4	0.500	0.20	1.571	0.668	
5	0.625	0.31	1.963	1.043	
6	0.750	0.44	2.356	1.503	
7	0.875	0.60	2.749	2.044	
8	1.000	0.79	3.142	2.670	
9	1.128	1.00	3.544	3.400	(c)
10	1.270	1.27	3.990	4.303	(c)
11	1.410	1.56	4.430	5.313	(c)

NOTES:

(a) Bar numbers denote nominal diameters of round bars in eighths-of-an inch. The nominal diameter of a deformed bar is equivalent to the diameter of a plain bar having the same weight per linear foot as the deformed bar.

(b) ¼ inch diameter bar in plan round only.

B. Dowel Bars: Plain steel bars.

C. Tie Bars: Deformed in accordance with ASTM A-305 except that No. 2 bars may be either deformed or plain. Tie bars which are to be bent during construction shall conform to ASTM A-614 grade 40.

- D. Welded Steel Wire Fabric: Welded steel wire fabric for concrete reinforcement shall:
1. Conform to the requirements of ASTM A-185 for smooth wire or ASTM A-47 for deformed wire.
 2. Wire used in the manufacture of welded wire fabric shall conform to Cold Drawn Steel Wire ASTM A-82.
 3. When wire is ordered by size number, the following relationship between size number, diameter and area shall apply.

PART 3 – EXECUTION

3.01 FORMWORK REMOVAL

- A. Formwork is to be removed after 48 hours or when the concrete reaches 50% design strength capacity as shown by concrete cylinder testing.

3.02 CONCRETE FINISH

- A. After formwork removal, concrete is to have a brushed finish.

END OF SECTION

SPECIAL HEALTH AND SAFETY CONSIDERATIONS.

- A. **COMPETENT PERSON.** The designated competent person should have and be able to demonstrate the following:
- Training, experience, and knowledge of:
 - soil analysis;
 - use of protective systems; and
 - requirements of [29 CFR Part 1926 Subpart P](#).
 - Ability to detect:
 - conditions that could result in cave-ins;
 - failures in protective systems;
 - hazardous atmospheres; and
 - other hazards including those associated with confined spaces.
 - Authority to take prompt corrective measures to eliminate existing and predictable hazards and to stop work when required.
- B. **SURFACE CROSSING OF TRENCHES.** Surface crossing of trenches should be discouraged; however, if trenches must be crossed, such crossings are permitted only under the following conditions:
- Vehicle crossings must be designed by and installed under the supervision of a registered professional engineer.
 - Walkways or bridges must be provided for foot traffic. These structures shall:
 - have a safety factor of 4;
 - have a minimum clear width of 20 in (0.51 m);
 - be fitted with standard rails; and
 - extend a minimum of 24 in (.61 m) past the surface edge of the trench.
- C. **INGRESS AND EGRESS.** Access to and exit from the trench require the following conditions:
- Trenches 4 ft or more in depth should be provided with a fixed means of egress.

- Spacing between ladders or other means of egress must be such that a worker will not have to travel more than 25 ft laterally to the nearest means of egress.
- Ladders must be secured and extend a minimum of 36 in (0.9 m) above the landing.
- Metal ladders should be used with caution, particularly when electric utilities are present.

D. **EXPOSURE TO VEHICLES.** Procedures to protect employees from being injured or killed by vehicle traffic include:

- Providing employees with and requiring them to wear warning vests or other suitable garments marked with or made of reflectorized or high-visibility materials.
- Requiring a designated, trained flagperson along with signs, signals, and barricades when necessary.

E. **EXPOSURE TO FALLING LOADS.** Employees must be protected from loads or objects falling from lifting or digging equipment. Procedures designed to ensure their protection include:

- Employees are not permitted to work under raised loads.
- Employees are required to stand away from equipment that is being loaded or unloaded.
- Equipment operators or truck drivers may stay in their equipment during loading and unloading if the equipment is properly equipped with a cab shield or adequate canopy.

F. **WARNING SYSTEMS FOR MOBILE EQUIPMENT.** The following steps should be taken to prevent vehicles from accidentally falling into the trench:

- Barricades must be installed where necessary.
- Hand or mechanical signals must be used as required.

- Stop logs must be installed if there is a danger of vehicles falling into the trench.
- Soil should be graded away from the excavation; this will assist in vehicle control and channeling of run-off water.

G. **HAZARDOUS ATMOSPHERES AND CONFINED SPACES.** Employees shall not be permitted to work in hazardous and/or toxic atmospheres. Such atmospheres include those with:

- Less than 19.5% or more than 23.5% oxygen;
- A combustible gas concentration greater than 20% of the lower flammable limit; and
- Concentrations of hazardous substances that exceed those specified in the *Threshold Limit Values for Airborne Contaminants* established by the ACGIH (American Conference of Governmental Industrial Hygienists).

All operations involving such atmospheres must be conducted in accordance with OSHA requirements for occupational health and environmental controls (see [Subpart D of 29 CFR 1926](#)) for personal protective equipment and for lifesaving equipment (see [Subpart E, 29 CFR 1926](#)). Engineering controls (e.g., ventilation) and respiratory protection may be required.

When testing for atmospheric contaminants, the following should be considered:

- Testing should be conducted before employees enter the trench and should be done regularly to ensure that the trench remains safe.
- The frequency of testing should be increased if equipment is operating in the trench.
- Testing frequency should also be increased if welding, cutting, or burning is done in the trench.

Employees required to wear respiratory protection must be trained, fit-

tested, and enrolled in a respiratory protection program. Some trenches qualify as confined spaces. When this occurs, compliance with the Confined Space Standard is also required.

- H. **EMERGENCY RESCUE EQUIPMENT.** Emergency rescue equipment is required when a hazardous atmosphere exists or can reasonably be expected to exist. Requirements are as follows:
- Respirators must be of the type suitable for the exposure. Employees must be trained in their use and a respirator program must be instituted.
 - Attended (at all times) lifelines must be provided when employees enter bell-bottom pier holes, deep confined spaces, or other similar hazards.
 - Employees who enter confined spaces must be trained.
- I. **STANDING WATER AND WATER ACCUMULATION.** Methods for controlling standing water and water accumulation must be provided and should consist of the following if employees are permitted to work in the excavation:
- Use of special support or shield systems approved by a registered professional engineer.
 - Water removal equipment, i.e. well pointing, used and monitored by a competent person.
 - Safety harnesses and lifelines used in conformance with 29 CFR [1926.104](#).
 - Surface water diverted away from the trench.
 - Employees removed from the trench during rainstorms.
 - Trenches carefully inspected by a competent person after each rain and before employees are permitted to re-enter the trench.
- J. **INSPECTIONS.** Inspections shall be made by a competent person and should be documented. The following guide specifies the frequency and conditions requiring inspections:

- Daily and before the start of each shift;
- As dictated by the work being done in the trench;
- After every rainstorm;
- After other events that could increase hazards, e.g. snowstorm, windstorm, thaw, earthquake, etc.;
- When fissures, tension cracks, sloughing, undercutting, water seepage, bulging at the bottom, or other similar conditions occur;
- When there is a change in the size, location, or placement of the spoil pile; and
- When there is any indication of change or movement in adjacent structures.



STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES

William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243
PHONE: 615-532-0191 FAX: 615-532-0686

December 11, 2015

RECEIVED DEC 16 2015

Mr. Jeff Harmon, PE
Johnson City Water Department
903 Riverview Drive
PO Box 2466
Johnson City TN 37605

RE: Johnson City Water Department (PWSID# 0000331)
Washington County
Project Number DW 15-1319
Standard Specifications for Water Line Construction

Dear Mr. Harmon:

This letter acknowledges receipt of four copies of standard construction specifications for the Johnson City Water Department. We have reviewed the specifications and found them satisfactory. The specifications have been stamped to indicate our approval. This approval is valid for three years and will expire on December 11, 2018. You must then either resubmit the standard specifications or request in writing for extension of approval.

The approved standard specifications may be referenced on any plans submitted for approval before the expiration date. We are retaining one copy of the standard specifications for our records, and are returning the remaining copies to you. All addenda, revisions or correspondence concerning these specifications should contain the DW Project Number as referenced. If you have any questions contact us at (615) 532-0191.

Very truly yours,

R. William Hench, P.E.
Drinking Water Engineering
Division of Water Resources

RWH/ DWS-35

cc: Johnson City Field Office – Water Resources