

SECTION 6000 – PIPELINE EXCAVATION, TRENCHING AND BACKFILLING

6001 SCOPE. This section covers the excavation, trenching, bedding, backfilling and other appurtenant work required for underground pipeline installations.

6002 GENERAL REQUIREMENTS. Excavation work shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards. Excavations shall provide adequate working space and clearances. In no case shall excavation faces be undercut for extended footings.

Excavations for manholes and similar structures shall provide sufficient clearance for exterior work such as pipe installation and wrapping of manhole section joints.

Backfilling during freezing weather shall not be permitted, unless otherwise approved by the City Engineer. No backfill material shall be installed on frozen surfaces, nor shall frozen materials, snow or ice be placed in any backfill.

6003 CLASSIFICATION OF EXCAVATED MATERIALS. When specifically indicated in the approved plans, classification of excavated materials will be made as follows:

- a. Rock. In accordance with the Technical Specifications.
- b. Earth. All material not classified as rock.

6004 CLEARING. The contractor shall clear all areas necessary for access, storage of pipeline materials and construction of the pipeline and appurtenant structures in conformance with the Technical Specifications.

6005 DEWATERING. The contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations and trenches. Dewatering operations shall continue throughout embedment preparation until the pipe installation is completed and no damage from hydrostatic pressure, flotation or other cause will result.

All excavations for trenches, which extend down to or below groundwater, shall be dewatered by excavating adjacent to the trench. The dewatering excavation shall lower the groundwater elevation to twelve (12) inches or more below the bottom of the trench.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

The Contractor shall be responsible for maintaining any pipe utilized for drainage purposes, and all such pipes shall remain clean and free of sediment.

6006 SHEETING AND SHORING. Sheet piling and shoring shall conform to the requirements in the Technical Specifications.

6007 ALIGNMENT AND GRADE. The alignment and grade or elevation of each pipeline shall be maintained as shown on the approved plans.

6008 MINIMUM COVER (Water Mains and Service Lines). Where pipe grades or elevations are not definitively fixed by the approved plans, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill covering the top of the pipe of forty-two (42) inches in unpaved areas and forty-eight (48) inches in paved areas. Greater pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes, conduits, drains, drainage structures or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation.

6009 STABILIZATION. Trench bottoms which become unstable during construction operations shall be stabilized, at the expense of the Contractor. Stabilization shall be achieved using crushed rock or other suitable material as necessary to provide a firm and stable base. Not more than one-half (1/2) inch depth of mud shall be allowed to remain on the stabilized trench bottom when the granular pipe bedding is installed.

6010 TRENCH EXCAVATION. The contractor shall not open more trench in advance of laying pipe than is necessary to expedite the work. One hundred-fifty (150) feet shall be the maximum length of open trench on any line under construction. The Contractor shall backfill all open trenches by the end of the work day, except as necessary for inspection or continuation of the work.

Except where alternate methods of construction are shown on the approved project plans, all trench excavations shall be open cut from the surface, unless otherwise approved by the City Engineer.

The Contractor shall be responsible for the safety of the excavation, which shall comply with all OSHA regulations pertaining to trench safety. All open trenches shall be provided with adequate protective devices.

6011 LIMITING TRENCH WIDTHS. Trenches shall be excavated to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, and embedment. Rock encountered during excavation shall be removed to provide a clearance of six (6) inches below and on each side of all pipes. These distances are minimum clear distances which will be permitted between part of the pipe and any part, projection, or point of such rock.

Cutting trench banks on slopes to reduce earth load to prevent sliding and caving will be permitted only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits. Slopes shall not extend lower than one (1) foot above the top of the pipe.

Trench widths below an elevation of one (1) foot above the exterior top of the installed pipe shall be not less than fifteen (15) inches nor more than twenty-four (24) inches greater than the nominal outside diameter of the pipe.

6012 UNAUTHORIZED TRENCH WIDTHS. Where the width of the lower portion of the trench exceeds the widths permitted in these Technical Specifications, special pipe embedment shall be used as determined by the City Engineer at the expense of the Contractor.

6013 MECHANICAL EXCAVATION. The use of mechanical equipment shall not be permitted in locations where its operation could cause damage to trees, buildings, culverts or other existing property, utilities or structures above or below ground.

Mechanical equipment used for trench excavation shall be capable of excavating the trench to the depth, width and alignment required to install the pipeline in accordance with the approved plans and Standard Details. Undercutting the trench sidewall to obtain clearance will not be permitted.

6014 ARTIFICIAL FOUNDATIONS IN TRENCHES. As directed by the City Engineer, the Contractor shall over excavate and stabilize the trench with suitable material to provide a stable foundation. All concrete or other foundations shall be installed as directed by the City Engineer. Compensation for extra excavation, concrete, or other foundations, except where provided by contract unit prices, shall be made in accordance with the contract provisions for extra work.

6015 PIPE BEDDING. The pipe shall be laid in a flat-bottom trench which has been graded and shaped to provide continuous support along the full length of the pipe and pipe joints. Blocking of the pipe will not be permitted. It shall be permissible to slightly disturb the finished subgrade surface by withdrawal of pipe slings or other lifting tackle.

After each pipe has been graded, aligned, placed and jointed on the bedding material, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations.

Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement. Spreading and compacting of the embedment material above the top of the pipe shall be done in a manner that does not damage or compromise the shape of the pipe.

Granular material used for embedment shall meet KDOT Standard Specification 1107, PB-2 gradation. The embedment material shall not contain clay lumps or organic matter.

A. Water Mains: Bell holes shall be excavated in the bottom of the trench to provide ample working space and ensure proper pipe support. No part of the bell shall be in contact with the trench bottom.

Granular embedment material is required for all pipe installations, including rock excavations, and shall conform to the Standard Details.

B. Sanitary Sewers: Granular embedment material conforming to the Standard Details is required for all pipe installations. Granular embedment material shall completely envelope all sanitary sewer mains, service connections and lateral lines (to the right-of-way).

Bell holes shall provide adequate clearance for tools and methods used for pipe installation. No part of any bell or coupling shall be in contact with the trench bottom, trench walls or granular embedment at the time the pipe is jointed.

Groundwater barriers shall be provided to impede the conveyance of groundwater along the pipe at approximately the midpoint of the pipe when the distance between manholes exceeds 280 feet. Groundwater barriers for sewer lines shall be flowable fill consisting of one four (4) feet long, impervious plug spanning the full width and depth of the trench. The flowable Fill shall have a maximum 28-day compressive strength of 100 psi and conform to KDOT Standard Specification Section 843 for Low-Strength Mixture. The 4-foot groundwater barrier shall not be located within a proposed street.

C. Storm Sewers: Pipe embedment for storm sewers shall conform to the Standard Details.

6016 PIPE INSTALLATION. All work shall be in accordance with the following standards or as specified herein. Prior to backfill, all pipe installations shall be inspected by an authorized representative of the city. All pipe not inspected prior to installation shall be uncovered and inspected.

Flexible Thermoplastic Pipe; ASTM D2321

Ductile Iron Water Mains; AWWA C600

Polyvinyl Chloride Water Mains, C900

High-Density Polyethylene Pipe, ASTM D2321

Reinforced Concrete Pipe

Joints for reinforced concrete pipe shall conform to Section 7 of ASTM C361, except that gaskets shall have a circular cross section and shall be confined in a groove in the pipe spigot. Pipe with collars in lieu of integral bells will not be acceptable.

Core holes and handling holes in concrete pipe shall be repaired by cementing a properly-shaped concrete plug in place with epoxy cement or by other methods acceptable to the engineer.

Lateral displacement of the pipe shall be prevented during embedment operations. Pipe shall not be laid in water, nor under unsuitable weather or trench conditions.

All joint preparation and jointing operations shall comply with the instructions and recommendations of the pipe manufacturer.

Hooks shall not be permitted to contact joint surfaces. Care shall be exercised in handling all pipes to prevent damage to pipe ends. Damaged pipe or pipe damaged in laying shall be replaced by and at the expense of the contractor.

6017 TRENCH BACKFILL. The requirements of this section refer to the portion of the trench that is located above the embedment material.

Future Street Crossings: All future street crossings, from back of the curb to back of the curb, shall be backfilled with flowable fill as measured from the top of pipe embedment to the bottom of the future subgrade.

Flowable fill used for backfilling shall meet KDOT Standard Specification Section 843.

Existing Street Crossings: All existing street crossings, from four (4) feet back of the curb to four (4) feet back of the curb, shall be backfilled with flowable fill from the top of pipe embedment to the bottom of street patch and shall conform to the Standard Details. The flowable fill shall have a maximum 28-day compressive strength of 100 psi and conform to KDOT Standard Specification Section 843 for Low-Strength Mixture.

All Other Locations: Compacting backfill shall be required for the full depth of the trench above the embedment at all other locations unless otherwise specified or directed by the City Engineer. The backfill material for trenches located within the right-of-way shall be compacted to ninety-five (95) percent of maximum density at optimum moisture. Trenches located outside of the right-of-way or other paved areas shall be compacted to ninety (90) percent of maximum density at optimum moisture unless otherwise specified or directed by the City Engineer.

At the option of the Contractor, compacted backfill may be job-excavated material or graded gravel unless otherwise specified or directed by the City Engineer. Job-excavated material may be used for compacted trench backfill when the job-excavated material is finely divided and free from debris, organic material, cinders or other corrosive material. Job-excavated material may contain rubble and detritus from rock excavation, stones, and boulders but none shall be placed within three (3) feet of the top of the pipe or in the upper eighteen (18) inches of the trench. The material resulting from rock excavation may be placed in the remaining area of the trench providing the material is of sufficient gradation to prevent future trench settlement. Job-excavated material used for trench backfill shall be approved by the City Engineer prior to use.

Compact masses of stiff clay or other consolidated material more than one (1) cubic foot in volume shall not be permitted to fall more than five (5) feet into the trench unless cushioned by at least three (3) feet of backfill material placed above the top of the pipe.

Backfill shall not be placed when material contains frost, is frozen or a blanket of snow prevents proper compaction. Backfill shall not contain waste material, organic material or debris of any kind.

The top portion of the backfill beneath established sodded areas shall be finished with at least six (6) inches of topsoil corresponding to, or better than, the adjacent topsoil. Topsoil shall be approved by the City Engineer prior to placement, and unless otherwise directed, shall be material previously excavated and stockpiled for that purpose during excavating and grading operations. Grades on areas to receive topsoil shall be established and maintained as a part of the grading operations. Immediately prior to spreading topsoil, the surface shall be loosened by discing or scarifying to a depth of two (2) inches to permit bonding of the topsoil to the underlying surface.

6018 FLOWABLE FILL. No material shall be used until it has been checked or tested for compliance with these specifications and approved by the engineer. Representative samples of all materials proposed for use under these specifications shall be submitted to a private laboratory by the contractor, at the contractor's expense, for testing and preparation of trial mixes to determine the mix design. All tests necessary for determining conformance with the requirements specified herein shall be at the contractor's expense. KCMMB mix design for flowable fill shall be submitted to the city for approval.

Laboratory test specimen(s) of the slurry mix, combined in proportions of the job mix design,

shall be prepared and tested and shall meet the following requirements:

Removable:

28-day Compressive Strength	200 psi (1400 kPa) (maximum)
Final Set, ASTM C266	2 hrs. (maximum)

Mix Design (+/-):

Cement.....	144 lbs.
Water.....	396 lbs.
Sand.....	2698 lbs.
A/E.....	13%

At the time of delivery, the slurry shall not be less than 60 degrees F (16 degrees C) nor more than 80 degrees F (27 degrees C).

Slurry shall not be placed on frozen material nor be used to displace water. It shall be placed to fill the voids and to the grades shown on the plans or as directed by the engineer. It shall not be used to displace or replace pavement materials.

6019 STRUCTURE BACKFILL. Backfill around structures shall be compacted to ninety-five (95) percent of maximum density at optimum moisture, unless otherwise approved by the City Engineer. Granular material conforming to KDOT Standard Specification Section 1107 Aggregates for Backfill, PB-2, shall be used to backfill structures located within the street to four (4) feet back of the curb unless otherwise specified or approved by the City Engineer. Weep holes for storm sewer structures shall not be obstructed with impervious backfill.

The required moisture content shall adhere KDOT MR3-3. A maximum of 3 percentage points above optimum, and a maximum of 3 percentage points below optimum.

Material for soil backfill shall be composed of earth only and shall contain no wood, grass, roots, broken concrete, stones, trash or debris of any kind. The backfill material shall require the approval of the City Engineer prior to placement, and shall not be deposited or compacted in water.

Backfilling of structures shall not occur prior to three (3) days after form removal or until the concrete has attained design strength in accordance with the Technical Specifications.

6020 DENSITY TESTING. In-place field density testing to determine compliance with specified compaction requirements must be performed every lift every one thousand (1000) feet unless otherwise requested by the contractor at the recommendation of a Geotech and approved by the City Engineer. If, as a result of this field testing, the City Engineer determines that further compaction is required, the contractor shall revise his compaction procedures to obtain the results specified or remove and replace the backfill material with flowable fill.

6021 TUNNEL AND CASING PIPE INSTALLATION. Steel casing for bored and jacked construction shall have a smooth wall and minimum yield strength of 35,000 psi, conforming to ASTM A-139. Casing pipes installed under railroads and highways shall conform to the jurisdictional agency's requirements. All other casing installations shall be Grade A. Steel casing pipe shall have welded joints in accordance with AWWA C-206 and shall have minimum wall thickness as indicated in Table 6021-1.

Table 6021-1 - Steel Casing Pipe Wall Thickness

Casing Diameter (inch)	Minimum Wall Thickness without Exterior Coating
14 and under	0.188
16	0.188
18	0.250
20	0.281
22	0.281
24	0.281
26	0.312
28	0.312
30	0.312
32	0.344
34	0.344
36	0.344
38	0.344
40	0.375
42	0.375
44	0.438
46	0.438
48	0.438
50	0.500
52	0.500
54	0.500
56	0.500
58	0.500
60	0.500
62	0.625
64	0.625
66	0.625
68	0.750
70	0.750
72	0.750

Boring and jacking operations shall be performed by experienced crews using a rotary type boring machine. The casing shall be jacked into place as the boring proceeds. Earth displaced by the installation of the casing shall be removed through the interior of the casing by hand, auger or other acceptable means. There shall be no voids between the earth and the exterior of the casing. Any voids that do occur shall be filled by pressure grouting with a grout mix approved by the City Engineer. The steel casing shall be cleaned of all debris after its installation is complete. Alternate methods of boring for casing pipe shall not be performed without the approval of the City Engineer.

Casing spacers with plastic runners shall be secured to the barrel of the pipe with metal bands in such a manner to support the weight of the pipe along its full barrel length on the skids without any of the weight supported by the pipe bell, and in such a manner as to properly position the

carrier pipe to the specified elevation and alignment. Stainless steel casing spacers with plastic skids shall be as specified on the Approved Materials List. The location of the spacers on the carrier pipe shall be determined by the Design Engineer and as recommended by the spacer manufacturer. End seals shall be used at each end of the casing and shall be the single-piece pull over, synthetic rubber type, using stainless steel bands.

6022 DRAINAGE MAINTENANCE. Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or water courses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the trafficway. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor. Water shall not accumulate in unfilled or partially-filled trenches. All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the original section, grades and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary.

6023 PROTECTION OF TRENCH BACKFILL IN DRAINAGE COURSES. Where trenches are constructed in ditches or other water courses, backfill shall be protected from surface erosion. When the grade of the ditch exceeds one (1) percent, ditch checks shall be installed. Unless otherwise shown on the drawings or directed by the City Engineer, ditch checks shall be concrete. Ditch checks shall extend not less than two (2) feet below the original ditch or water course flowline for the full bottom width, at least eighteen (18) inches into the side slopes and shall be at least twelve (12) inches thick.

6024 DISPOSAL OF EXCESS EXCAVATED MATERIALS. Except as otherwise permitted, all excess excavated materials shall not be disposed on the project site.

Excess earth from excavations located in unimproved property shall be distributed directly over the pipe trench and within the pipeline right-of-way to a maximum depth of six (6) inches above the original ground surface elevation. The excess material shall be graded to a uniform surface without obstructing drainage at any point. Wasting of excess excavated material in the above manner will not be permitted where the trench crosses or is within a railroad, public road or highway right-of-way. The disposal of waste and excess excavated materials, including hauling, handling, grading and surfacing shall be a subsidiary obligation of the Contractor and no separate payment will be made therefore.

6025 SETTLEMENT. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which occur within two (2) years of time after final acceptance of the work.

A suitable maintenance bond in an amount approved by the City Engineer shall be furnished to the City of Gardner by the Contractor guaranteeing the maintenance of the construction under which the contract was performed. Said bond shall remain in effect for two (2) years from the date of final acceptance by the City Council.

The Contractor shall repair settlement deficiencies within thirty (30) days after notice from the City Engineer.