SECTION 19 - TRENCH EXCAVATION, BEDDING AND BACKFILL
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SECTION 19 TRENCH EXCAVATION, BEDDING AND BACKFILL

19-1 TRENCH EXCAVATION

Trench excavation shall include the removal of all materials or obstructions and the control of water as necessary to construct the Work as shown or specified in the Contract. Unless otherwise shown or specified in the Contract, excavation shall be by open cut or as directed by the Agency.

Attention is directed to Section 10-5, "Control of Water in the Work", and Section 14, "Restoration of Surfaces", of these Specifications, for additional requirements. Surface water shall not be allowed to enter any pipe trench and shall not be permitted to enter the existing downstream pipe system.

Section 18-2.03, "Surplus Material" and Section 18-7, "Surplus Material Disposal", of these Specifications also applies to excess material from trench excavations.

19-1.01 Exploratory Excavation

An encroachment permit shall be obtained from the Agency prior to any exploratory excavation within highway rights-of-way or other public easements. Prior to the end of each Working Day, exploratory excavations made outside the paved surface during that Working Day shall be backfilled with sand or native excavated materials as directed by Agency and mechanically compacted to prevent subsequent settlement. Excavations made within the paved surface shall be permanently restored per Standard Drawing 4-31.

19-1.02 Trench Width

Minimum and maximum trench widths at the top of the pipe shall be as shown or specified in the Contract Documents or as specified in these Standard Specifications.

19-1.02.A Storm Drain Pipe

Unless otherwise shown or specified in the Contract, for storm drain pipe the minimum and maximum trench width shall be as shown on Standard Drawing 9-1. If trench widths at the top of the pipe are exceeded by any amount, the Contractor shall provide stronger pipe or improved bedding and backfill conditions, as approved by the Agency to meet the changed load requirements. If the trench width is exceeded for any reason within the Contractor's control, the stronger pipe or improved bedding and backfill shall be provided at the Contractor's expense.

19-1.02.B Sewer Pipe

Unless otherwise shown or specified in the Contract, minimum trench widths at the top of the pipe shall be as shown or in the table below, and the maximum widths shall be as shown on Standard Drawings 7-4 and 7-15. For rigid pipes <12", refer to Standard Drawing 7-15. For semi-rigid pipe, the Agency will provide trench and pipe design calculations.

Pipe Size (Inches)	Minimum Trench Width (Inches)
12	OD+12
15	OD+13
18	OD+15
21	OD+16
24	OD+17
27	OD+18
30	OD+19
33	OD+20
36	OD+22
Based on Minimum Working Space	

If maximum trench widths at the top of the pipe are exceeded by any amount, the Contractor shall provide stronger pipe or improved bedding and backfill conditions, as approved or directed by the Agency, to meet the changed load requirements. The stronger pipe or improved bedding and backfill shall be provided at no additional expense to the Agency.

19-1.02.C Water Pipe

Water pipe minimum and maximum trench widths shall be as shown on Standard Drawing 8-17 unless otherwise shown or specified in the Contract. If trench widths at the top of the pipe are exceeded by any amount, the Contractor shall provide stronger pipe or improved bedding and backfill conditions, as approved by the Agency to meet the changed load requirements. If the trench width is exceeded for any reason within the Contractor's control, the stronger pipe or improved bedding and backfill shall be provided at the Contractor's expense.

19-1.03 Pavement Cutting

When the trench is in an existing paved area, the pavement shall be saw cut on neat lines parallel and equidistant from the trench centerline. The width of the saw cut shall not be any greater than is required to properly install the pipe and not damage the edges of the pavement left in place, or as directed by the Agency. Pavement between the lines shall be broken and removed as directed by the Agency immediately ahead of the trenching operations. The existing pavement shall be removed in conformance with Standard Drawing 4-31. Top backfill in existing paved areas shall conform to Standard Drawing 4-31.

Pavement shall not be cut until the respective utility companies have marked the location of their underground facilities and the Agency has given final approval of the trench alignment.

19-1.04 Maximum Length of Open Trench

Unless otherwise specified in these Specifications or the Special Provisions, or approved by the Agency in writing, at the end of each Working Day, there shall be no more than three hundred feet (300') of trench at any one location allowed to remain open, including excavation, pipe laying and appurtenant construction and backfill which has not been temporarily resurfaced, but excluding manhole excavations . The remainder of the trench shall be backfilled and compacted, and when in streets, opened to traffic as soon as possible. The maximum length of trench open for cast-in-place concrete pipe shall be as specified in Section 36-3, "Trench Excavation", of these Specifications.

Failure by the Contractor to comply with the limitations specified herein may result in a temporary suspension of work in accordance with Section 5-21, "Temporary Suspension or Delay of Work", of these Specifications.

19-1.05 Control of Water

Control of water shall conform to the requirements in Section 10-5, "Control of Water in the Work", of these Specifications.

19-1.06 Shoring and Bracing

The Contractor shall furnish and install sufficient shoring and bracing to insure the safety of personnel and public, protect the Work, and protect adjacent improvements. Contractor must comply with all of the requirements of Section 6-20, "Excavation and Trench Safety", of these Specifications.

Sheeting shall not extend below the bottom of the pipe barrel. The contractor shall take care to prevent damage to existing surface or subsurface improvements, both public and private, during drilling and driving operations. Unless otherwise specified in the Special Provisions or required by the Agency, all sheeting, timbering, lagging, and bracing shall be removed during backfilling, and in such a manner to prevent any movement of the ground or damage to the pipe or to other structures. When the Agency requires that sheet piling, lagging, and bracing be left in place, such materials shall be cut off where designated and the upper part withdrawn. If steel piling is used, it may be removed simultaneously with placing and compacting of backfill.

When using movable trench supports, care shall be exercised to prevent disturbing the pipe location, jointing, or embedment. Removal of any trench protection below the top of the pipe and within two and one-half (2-1/2) pipe diameters of each side of the pipe will be prohibited after the pipe embedment has been placed and compacted. Movable trench supports shall only be used in either wide trench construction where supports extend below the top of the pipe or on a shelf above the pipe with the pipe installed in a narrow, vertical wall subditch. Any voids left in the trench wall or embedment materials by support removal shall be carefully filled with bedding material and compacted. Removal of bracing between sheeting shall only be done where backfilling proceeds and bracing is removed in a manner that does not relax trench support.

19-1.07 Special Foundation Treatment

Whenever the bottom of the trench is soft, spongy, unstable, rocky, or, in the opinion of the Agency, otherwise unsuitable as a foundation for pipe bedding, the unsuitable material shall be removed to a minimum depth of six inches (6"), or to a depth designated by the Agency, and replaced with compacted crushed rock, gravel, or sand as directed by the Agency. When the trench bottom is cobbled or of any other material which might, in the opinion of the Agency, allow loss of sand backfill, the backfill material shall be crushed rock or gravel graduated so that one hundred percent (100%) will pass the three-quarter inch (3/4") sieve and not more than fifteen percent (15%) will pass the number 8 sieve. Crushed rock or gravel shall conform to Section 50-16, "Clean Crushed Rock", of these Specifications. Sand backfill, when permitted by the Agency, shall conform to the requirements in Section 50-13.01, "River Sand", of these Specifications. Such backfill material shall be compacted to a non-yielding condition. Jetting is not permitted. As an alternate to the bedding materials specified above, the Agency may direct the Contractor to furnish and place geotextile fabric below the bedding materials. The geotextile material shall be a woven fabric in accordance with Section 50-10.02, "Woven Geotextile Fabric", of these Specifications. Furnishing and placing of geotextile fabric will be paid for as extra work as provided in Section 9, "Changes and Claims", of these Specifications.

If material more than twelve inches (12") below the typical trench bottom is ordered removed by the Agency, the excavation below that point and the imported material required to backfill the trench to that elevation will be paid for as extra work as provided in Section 9, "Changes and Claims", of these Specifications unless otherwise specified in the Special Provisions. Before excavation of the pipe trench in fill areas or roadway embankments, the fill area or embankment shall be completed to a height above the pipe invert grade line of not less than twice the internal pipe diameter or to final fill or embankment subgrade, whichever is lower, but in no case less than twelve inches (12") above the top of the pipe. Such embankment shall be compacted to a minimum relative compaction of ninety percent (90%) for a distance on each side of the pipe

equal to at least two (2) pipe diameters. The remainder of the embankment shall be compacted to the minimum relative compaction specified elsewhere in these Specifications for the type of construction being done, or as specified in the Special Provisions or on the Plans. Special foundation treatment for cast-in-place concrete pipe shall be as specified in Section 36-4, "Cast-In-Place Concrete Pipe (CIPCP) - Special Foundation Treatment", of these Specifications.

19-1.08 Excavation Method

Methods used in excavation shall not cause damage to surrounding property or damage remaining pavement and other existing improvements that are to remain. Outriggers for excavation equipment, and other heavy equipment, shall be fitted with street pads to prevent pavement damage.

19-1.09 Payment

Full compensation for trench excavation, including all equipment, labor, materials, control of water, shoring and bracing, and other safety measures required, is included in the prices paid per linear foot of the respective sizes, grades, and types of pipes listed in the Contract, and no additional compensation will be paid.

Additional bedding material used to stabilize the foundation if required, over the amount required by the Contract, will be paid for as provided in the Special Provisions. If the necessity for such additional bedding material has been caused by an act or failure to act on the part of the Contractor or is required for the control of groundwater, the Contractor shall bear the expense of the additional excavation and material.

19-2 PIPE BEDDING AND BACKFILLING OF TRENCHES

19-2.01 Pipe Bedding

Pipe bedding shall be furnished and placed as shown on the Plans and in accordance with the requirements in these Specifications. Pipe shall be placed on a firm layer of bedding material, and shall be bedded uniformly throughout its length. Pipe bedding material for water distribution systems shall conform to the requirements in Section 50-13.02, "Graded Sand", of these Specifications.

19-2.01.A Sewer

Pipe bedding material for sewer construction shall conform to the requirements as detailed on Standard Drawing 7-4, and in conformance with these Specifications. Bedding material shall be placed on a firm and unyielding foundation such that the pipe is supported for the full length of the barrel. There shall be at least five inches (5") of bedding material placed beneath the pipe. An additional minimum three inches (3") of bedding material shall be placed in contact with and beneath all pipe joint and couplings and one inch (1") minimum clearance below a projecting bell. Pipe bedding shall be vibratory compacted to a stable, non-yielding condition. Bell or coupling holes shall be carefully excavated so that no part is supported by the bell or coupling. Consolidation of the material around and under the bell and couplings during backfilling shall be avoided.

19-2.01.B Storm Drain

Unless otherwise indicated in the Contract, storm drain pipe bedding shall be furnished and placed as detailed in Standard Drawing 9-1 and in conformance with these Specifications. Storm drain pipe bedding material shall conform to Section 50-16, "Clean Crushed Rock", of these Specifications.

The Pipe shall be bedded uniformly throughout its length. The bearing shall be achieved by shaping the bedding or by lightly "bouncing" the pipe to set it into the bedding. Pipe bedding material shall be placed at a minimum thickness meeting the greater of the following criteria:

1. The minimum bedding thickness shall be three inches (3”) for pipe with internal diameter ten inches (10”) or less, and four inches (4”) for pipe with internal diameter twelve inches (12”) and greater; or
2. The minimum bedding thickness shall be equal to the difference between the outside diameter of the pipe barrel and bell plus one and one-half inches (1-1/2”); or
3. When soil conditions in the trench bottom are unstable, rocky, or otherwise unsuitable as a foundation for pipe bedding, the minimum bedding thickness shall conform to Section 19-1.07, "Trench Excavation - Special Foundation Treatment", in this Section.

19-2.01.C Water Distribution Systems

Polyvinyl Chloride (PVC) water distribution mains shall have four inches (4”) of sand bedding material that conforms to the requirements of Section 50-13.02, “Graded Sand”, of these Specifications. If existing soil is too porous to hold sand, four inches (4”) of crushed aggregate or a geotextile fabric placed on the trench bottom and covered with four inches (4”) of sand may be used. The Agency must approve the use and type of geotextile, and crushed aggregate.

Ductile Iron water distribution mains shall have six inches (6”) of sand bedding material that conforms to the requirements of Section 50-13.02, “Graded Sand”, of these Specifications. If existing soil is too porous to hold sand, a geotextile fabric placed on the trench bottom and covered with six inches (6”) of sand may be used. The use and type of geotextile must be approved by the Agency. The Ductile Iron distribution main, fittings, and cast iron fittings shall be encased in eight– (8) mil polyethylene encasement in accordance with AWWA C105.

19-2.02 Initial Backfill

Initial backfill shall be furnished and placed as shown or specified in the Contract, and in accordance with the requirements in these Specifications.

19-2.02.A Sewer

Unless otherwise specified in the Special Provisions, initial backfill for gravity sewer construction shall be as detailed on Standard Drawing 7-4. Initial backfill shall be the material between the top of the bedding material and twelve inches (12”) above the top of the pipe. Initial backfill material in the pipe haunch area shall be shovel-sliced to fill the voids and consolidate the material thus providing uniform and consistent support of the pipe. Shovel-slicing shall be performed along the pipe barrel and not adjacent to the bell hole. Shovel-slicing shall occur when the initial backfill is no higher than about one-fourth of the pipe diameter. The maximum lift shall not exceed eight inches (8”) thickness. Particular compaction effort shall be applied to all wye’s and tee’s.

19-2.02.B Storm Drain

Unless otherwise specified in the Special Provisions, the following initial backfill requirements shall apply. For cast-in-place concrete pipe, initial backfill shall conform to Section 36-14, “Cast-in-Place Concrete Pipe (CIPCP) – Backfill”, of these Specifications and Standard Drawing 9-1. For all other pipes initial backfill for storm drain construction shall conform to this Section 19 and Standard Drawing 9-1.

Granular materials shall conform to Section 50-16, "Clean Crushed Rock”, of these Specifications. For field conditions requiring control density backfill the material shall conform to Section 50-15, "Control Density Backfill", of these Specifications. For field conditions requiring portland cement concrete backfill the material shall conform to Section 50-5.01, "Portland Cement Concrete - Composition”, Class "B-2”, of these Specifications.

After placement of bedding, the Contractor shall place initial backfill material to the spring line of the pipe, thoroughly compacting it by vibratory drum roller, vibrating surface plate, insertion vibrator, shovel slicing or light tamping to provide proper support under the pipe haunches. The remaining initial backfill material shall be placed per Standard Drawing 9-1. To

reduce impact damage, there shall be at least twelve inches (12") of cover over pipe before using hand-held or walk-behind compaction equipment, and at least three feet (3') of cover before using ride-on equipment. Care shall be used not to disturb or displace the pipe. When using control density or concrete backfill, the Contractor shall anchor the pipe to prevent floating or displacement of the pipe. The anchors shall be spaced to insure a continuous even grade in the flow line of the pipe.

19-2.02.C Water Distribution Systems

Initial backfill for water distribution systems shall conform to the requirements of Standard Drawing 8-17. Unless otherwise specified in the Special Provisions, initial backfill for water distribution systems, including water mains, fire hydrant branch leads, and water services, shall be sand conforming to the requirements in Section 50-13.02, "Graded Sand", of these Specifications. Ductile iron distribution mains shall have sand backfill to eight inches (8") above the top of the distribution main. Initial backfill for PVC water distribution pipe may be of native material or sand. Initial backfill for ductile iron or cast iron fittings used with PVC pipe shall be sand to eight inches (8") above the top of the fittings.

Initial backfill shall be placed immediately after pipe joints have been completed and inspected by the Agency. The material shall be carefully placed so as not to disturb or damage the pipe, and shall be brought up evenly on both sides. Initial backfill material shall be placed in layers not exceeding eight inches (8") in depth before compaction at or near optimum moisture content. Compaction shall be by mechanical pneumatic or vibratory compaction equipment approved by the Agency. Ponding and jetting methods will not be permitted, although water may be sprayed from a two-inch (2") truck hose onto initial and final sand backfill. The compacted material must achieve a relative compaction of at least ninety percent (90%) as determined by ASTM Designation: D 698. If steel piling is used, it may be removed simultaneously with placement and compaction of intermediate backfill. Trench jacks or other shoring shall not be removed before completion of initial backfill.

19-2.03 Trench Backfill

Trench backfill shall consist of material placed between the initial backfill and subgrade in paved areas or to the top of the trench in unpaved areas, unless otherwise shown or specified in the Contract.

The trench backfill material may be native material excavated at the work site if the trench depth is greater than four feet (4') measured from the top pipe to the finished road surface. Such material must be free of organic or other unsuitable materials as determined by the Agency that may cause voids or depressions to develop during or after placement of the backfill. Rocks, stones and solid earth chunks exceeding three inches (3") in greatest dimension shall be removed from the trench backfill material.

Trench backfill material shall be placed in layers not exceeding eight inches (8") in depth before compaction at or near optimum moisture content. Until the total backfill above the top of the pipe exceeds three feet (3'), machine-placed backfill material shall not be allowed to "freefall" more than two feet (2'). Compaction effort shall be applied parallel to the pipeline starting at the trench wall and proceeding to the center of the trench.

The backfill material for trench depths less than four feet (4') measured from the top pipe to the finished road surface shall be imported granular material, uniformly graded Class 2 aggregate base conforming to the requirements in Section 50-7, "Aggregate Bases", of these Specifications. The imported granular material shall be placed in lifts not to exceed six inches (6") after compaction. Compaction requirements for imported granular material shall be the same as required for compaction of job excavated native material.

Unless otherwise shown or specified in the Contract, compaction of all backfill material shall be by mechanical pneumatic or vibratory compaction equipment appropriate to the existing

conditions that will not result in damage to adjacent ground, existing improvements or the Work. Ponding and jetting methods will not be permitted, except by written permission of the Agency.

Unless otherwise shown or specified in the Contract, trench backfill material shall be compacted to a relative compaction of not less than ninety percent (90%), as determined by ASTM Designation: D 1557. The top six inches (6") below the subgrade shall be compacted to a relative compaction of ninety-five percent (95%), except that trenches in easements outside the street rights-of-way may be compacted to ninety percent (90%) relative compaction throughout the depth. Compaction testing will be performed by the Owner and the cost thereof will be borne by the Agency, except that retests of areas which fail to meet the required compaction will be charged to the Contractor and deducted from any payment due the Contractor.

Unless otherwise specified in the Special Provisions, the Contractor has the option to use imported granular material for trench backfill in place of native material excavated at the work site. The imported granular material shall be uniformly graded Class 2 aggregate base conforming to the requirements in Section 50-7, "Aggregate Bases", of these Specifications. The imported granular material shall be placed in lifts not to exceed six inches (6") after compaction. Compaction requirements for imported granular material shall be the same as required for compaction of job excavated native material. Unless otherwise specified in the Special Provisions, the optional use of imported granular material for trench backfill will be at the Contractor's expense.

19-2.04 Payment

Full compensation for furnishing, placing, and compacting pipe bedding and trench backfill materials is included in the prices paid per linear foot of the respective sizes, grades, and types of pipes listed in the Contract, and no additional compensation will be paid.

Actual excavation quantities to be paid for will be calculated based on the maximum width of trench shown on the plan and measured at the top of the pipe.

Actual trench resurfacing quantities to be paid for will be calculated based upon the maximum width of trench as specified herein.