



BANGOR WATER DISTRICT

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Construction Technical Specifications

SECTION 1 - Water Main Construction

A. Description

This document addresses: excavation and backfill of the trench; furnishing, and installing cement-lined ductile iron pipe, valves, fittings, hydrants, and accessories of the types and classes described herein and shown on the plans; making connections to the existing public water supply system; pressure testing and disinfecting the completed installation; and incidental work as described herein.

Please refer to the Bangor Water District Standard Details for detailed drawings of the following items:

- Air Relief Valve Installation
- Typical Trench Detail
- Typical Trench Detail in Ledge
- Residential Meter and Backflow Installation
- Commercial Meter and Backflow Installation
- Thrust Block Specifications
- Hanging Thrust Block Installation
- Restraining C-900 Pipe
- Typical Main Tie-in to an Existing Main
- Typical Domestic / Fire Service Installation
- Fire Service Penetrations Through Walls and Under Wall Footings
- Typical Domestic Service Connection
- Hydrant Installation
- Offset Installation
- Permanent Style 2 inch Blow Off Installation

B. Excavation

All pipe shall be installed with a minimum five (5) foot depth of cover over the top of the pipe. Where existing or proposed pipes, conduits, culverts, cables, wires, etc. interfere with laying at this depth, the water pipe shall be laid at greater depth to clear the obstruction by at least twelve (12) inches, where practical.

Excavation shall be kept free of water and special precautions shall be taken to prevent entry of water, mud or other foreign substances into the line. Temporary caps shall be installed over all openings at the end of each day, when the work is suspended

for periods of 30 minutes or more (including lunch hours), or whenever necessary to protect the work in progress.

Pipes shall be carefully lowered into the excavation, be guided into proper position, and joined to the preceding length or fitting. Suitable excavated material (i.e. free of stones and capable of being properly compacted) or borrow shall be placed and tamped under and around the pipe, taking care to maintain equal depth on both sides and to prevent movement of the pipe from its proper alignment. Where directed by the District, due to soft or otherwise unsuitable bottom conditions, pipe bedding shall be placed in accordance with the requirements of BWD standard details.

All excavated areas shall be adequately shored and braced so that the earth will not slide or settle, and so that all existing improvements of any kind will be duly protected from damage. All damage resulting from inadequate bracing or shoring will be the responsibility of the Contractor. The Contractor shall make all necessary repairs and do reconstruction at his/her own expense. S/he will bear all other expenses resulting from any such damage due to lack of adequate shoring.

The Contractor will take special precautions on those projects that are near road curbs. Every effort shall be made to avoid disturbing any roadside curbing. Should it become necessary to disturb or remove curbing during water main installation, the Contractor shall, at his/her own expense, replace such curbing in accordance with construction practices in the latest edition of the Maine Dept. of Transportation Highway Specifications or local town specifications.

The Contractor shall note that in some areas underground sewer mains and services, storm drains, telephone or communications cables, gas lines, and other below-ground utilities may exist in close proximity to the work. Excavation around other utilities, pipes, culverts, and similar installations shall be done with extreme care. It shall be the Contractor's responsibility to contact the owner/operator of each utility to be encountered and obtain information relative to location and depth before excavating in the area. It shall be the contractor's responsibility to comply with the State of Maine "Dig Safe" law. The Contractor shall promptly notify the Utility Owner concerned in the event of damage occurring during construction, whether caused by him/her or others.

The Contractor shall use extra caution to avoid disturbing any water service connections along the proposed water main routes. Any disruption of water service or any damage to such service lines shall be immediately reported to the District and the property owner. It shall be the Contractor's responsibility to immediately repair any damage done to water services during installation of new water mains.

In the event that underground utilities conflict with the location of the work, the Contractor shall promptly notify the District and shall not disturb the conflicting utility until given specific instruction specifying the action to be taken.

Private utilities (building drains, etc.) encountered in the work shall be brought to the attention of the District and be handled in such manner as he directs.

Suitable material from excavation shall be used to the maximum extent possible in grading over and adjacent to the pipe and in filling adjacent low land as directed by the District. Materials that cannot be so placed shall be removed as directed by the District.

No separate payment will be made for excavation including labor, materials, and use of equipment and tools necessary to complete the excavation work. All materials used and work performed for excavation will be considered as incidental to other items of these specifications.

On portions of the project which are within the confines of an existing roadway, the Contractor shall provide for at least one-way traffic at all times with special regard for the safety of the traveling public. Traffic control shall be accomplished in accordance with M.D.O.T. specifications and shall be coordinated with the local Town Public Safety office.

Property owners whose driveways will be blocked for a short period of time will be notified 24 hours and one hour in advance of the excavation so that vehicles can be removed when necessary. Driveways shall not be blocked at night without the expressed consent of the property owner.

C. Test Pit Excavation

At such locations as may be determined by the District, the Contractor shall perform excavation to locate various subsurface utilities. The limits and depth of such excavations shall be determined by the District, and the Contractor shall perform all work as directed by the District. In addition, the Contractor shall carefully backfill the trench, using twelve (12) inch compacted layers, and restore the surface to a condition equal to or better than it was before.

D. Extra Earth Excavation

Where necessary during construction, the Contractor shall perform extra excavation where the District so directs. The following conditions may result in the Contractor performing extra excavation:

1. Necessity of installing water mains below other subsurface utilities
2. Discovery of unsuitable material in the trench bottom
3. Necessity of widening the trench beyond specified limits in order to remove or relocate structure/(s) encountered during construction

E. Blasting

The District has adopted the blasting requirements used by the City of Bangor. The Contractor must obtain a blasting permit from the City, which includes a pre-blast survey per City specifications.

The Contractor shall employ an experienced blaster and shall comply with all laws, ordinances, and applicable safety codes and regulations relative to the handling, storage, and use of explosives and protection of life and property. The Contractor shall be fully responsible for all damage thereto caused by his/her blasting operations. Signals warning persons of danger shall be given before every blast. Suitable weighted timer mats, wire rope mats, or other approved covering shall be provided to confine all materials lifted by blasting within the limits of the trench or excavation.

The excavated ledge material may be used in approved areas for backfilling the top half of the trench except that stone fragment exceeding the size of one cubic foot shall not be used in the backfill.

F. Excavated Material

All excavated material shall be placed in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Gutters and other means for providing surface drainage shall be kept clear at all times.

G. Preparation of Water Line Trench Bottom

Pipe shall be laid directly on the trench bottom.

H. Shaping Trench Bottom

Prior to lowering pipe into the trench, the trench bottom shall be made flat and cut true and even to grade so as to provide continuous contact of the trench bottom with the pipe.

I. Unsuitable Conditions

No pipe shall be laid in wet trench conditions, which preclude proper bedding, on frozen trench bottom, or when, in the opinion of the District, the trench conditions or the weather are unsuitable for proper installation.

J. Cutting Pipe

All cutting of iron pipe shall be done using an electrically, pneumatically, or gasoline operated machine. Blades shall be carbide tipped for cutting cement-lined iron pipe or abrasive type for proper material being cut. The machine used shall be portable saw equal to those made by Fein, Wache, or Homelite, or approved equal. When the cut end is to be used as a "Bell-Tite" or "Tyton" joint, it shall be tapered back on the outside of the cut about 1/8-inch, at an angle of about 30 degrees with the pipe center. This shall be done with a course file or portable grinder.

K. Connection to Existing Water Main

The Contractor shall locate and confirm sizes and materials of existing mains, excavate, furnish and install tapping sleeves and valves, and backfill the excavation. All materials, including mechanical joint accessories, valve boxes, and other items necessary to make all joints watertight and provide complete and effective connections to existing water mains shall be provided by the Contractor. All tapping sleeves shall be pressure tested prior to BWD tapping the main.

No valves on existing mains shall be operated by the Contractor without the permission of the Bangor Water District. The location of the points of connection and the locations of the existing mains are approximate only, and the Contractor shall provide all labor, equipment and material for all connections which shall be included in the Unit Bid price for tapping sleeves with valves.

All size on size taps shall be done with full body tapping sleeves meeting BWD material specifications.

L. Thrust Backing, Anchorage, and Joint Restraint Water Line Fittings

Thrust backing and anchorage is required wherever the pipe: a) changes direction as at tees, bends, crosses, and tapping sleeves; b) changes sizes, as at reducers; or c) stops, as at dead ends and hydrants.

Concrete shall be used for thrust blocks, and they shall be poured in place or pre-cast in accordance with BWD standard details. Poured in place thrust blocks shall be constructed by pouring concrete between the fitting and the undisturbed wall of the trench. A dry mixture shall be used so that the concrete may be easily shaped into the desired form, a wedge with the wide end against the solid wall. Care shall be exercised to ensure that the concrete is clear of joint accessories, bolts, nuts, and flanges.

The Contractor shall furnish and install all materials and equipment, and perform all labor for the manufacture, transporting, placing, curing, and testing concrete for thrust blocks. Concrete shall be composed of Portland cement, water, fine and coarse aggregate, and an air-entraining mixture. Accelerating or anti-freeze admixtures will not be permitted. Cement shall be Type II conforming to ASTM C150 or ASTM C175.

Aggregates shall conform to ASTM C33. For thrust blocks, all aggregates shall be able to pass through a screen with two (2) inch square openings.

Preferably, water used in mixing and curing concrete shall be potable. Non-potable water shall be fresh, clean and free from injurious amounts of sewage, oil, acid, alkali, salt, or organic matter.

Air entraining admixtures shall conform to the Specifications for Air Entraining Admixtures for Concrete (ASTM C260).

Unless otherwise shown on drawings, concrete used for thrust blocks shall have a 28-day compressive strength of 2,500 psi. When no preliminary strength tests of the concrete to be used are made, the water-cement ratio shall not exceed the following values.

Specified Compressive Strength at 28 days (psi)	Maximum permissible water-cement ratio, lb. of water per lb. of cement
2,000	0.70
2,500	0.55
3,000	0.46
3,500	0.40
4,000	0.35

Water-to-cement ratios other than the above may be used when the strengths of the concrete are to be established by tests. The District shall determine if concrete testing is necessary and shall also determine the method of any concrete testing which is performed. The slump of concrete for thrust blocks shall be the minimum that is practicable such that the concrete may be easily shaped into the desired form, a wedge with the wide end against the solid undisturbed wall. Segregation of materials in the mixture shall not be permitted. Forming and placing of concrete for thrust blocks shall be done under the direction of the District.

Curing and form removal for concrete thrust blocks, and requirements due to air temperature and weather conditions shall follow proper construction practices and shall be subject to approval by the District.

Minimum thrust block area against the undisturbed trench wall shall be as follows:

<u>Pipe Size</u>	<u>Fitting or Pipe Change</u>	<u>Min. thrust block area against undist. earth (square feet)</u>
6"	90 degrees	5.5
6"	11 1/4 degrees	1.5
6"	Dead end	6.5
8"	90 degree bend	6.5
8"	45 degree bend	5.0
12"	90 degree bend	20.0
12"	11 1/4 degree bend	4.5
12"	Dead end	22.0
8"	90 degree bend	6.5
8"	45 degree bend	5.0
12"	90 degree bend	20.0
12"	11 1/4 degree bend	4.5
12"	Dead end	22.0
16"	22 1/2 degree bend	9.5
16"	90 degree bend	23.5
20"	Dead end	41.0
12x12	Tapping sleeve	14.0
8x8	Tapping sleeve	9.5
6x6	Tapping sleeve	8.5
Hydrants		5.5
<u>Pipe Size</u>	<u>Fitting or Pipe Change</u>	<u>Min. thrust block area against undist. earth (square feet)</u>
16x16x16		8.5
16x16x8		9.5
16x16x12		14.0
20x20x6		8.5
20x20x16		26.5
12x12x6		8.5

In addition to the above requirements for thrust backing, water mains shall be protected from movement by thrust forces in the following manner:

1. All fittings, valves, hydrants, and caps shall have ductile iron standard glands, unless otherwise directed by the District.

2. All push-on joints in hydrant lateral shall be secured by rods as shown on the contract drawings or as directed by the District.

3. All valves shall be rodded to the tee.

Bolts on all ductile standard glands shall be systematically tightened with a torque wrench according to the manufacturer's requirements. When all bolts have been tightened in this manner, each bolt shall be retightened according to manufacturer's requirements in the event that some may have loosened during the initial tightening process.

When a fitting is used to make a vertical bend, anchor the fitting to a thrust block braced against undisturbed soil. The thrust block should have enough resistance to withstand upward and outward thrusts at the fitting.

All services, domestic and fire protection, must have separate shut-off valves.

SECTION 2 - Materials

Refer to the District's Materials Specifications for information.

SECTION 3 - Water Line Testing

A. Water line testing shall be done in accordance with AWWA specifications.

1. Chlorination shall be done in accordance with ANSI/AWWA C651-92, the AWWA standard for Disinfecting Water Mains Section 5.2, Continuous-Feed Method.
2. Integrity of the installed pipeline shall be confirmed using ANSI/AWWA C600-93, the AWWA standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

B. Sewer Line Crossings

Where the water main extensions cross a sewer line or house lateral, the water main joints shall be spaced such that no water main joint is closer than ten (10) feet to the sewer centerline. When possible, the water line shall be deflected such that it passes eighteen (18) inches over the sewer.

SECTION 4 - Common Borrow, Roadway Gravel, and Pipe Bedding

A. Description

Furnish and place common borrow where trench material is unsuitable, gravel for drives, and parking areas, and granular pipe bedding as directed by the District at locations where the existing soil conditions are unsuitable.

B. Common Borrow

Borrow material shall contain no rocks or fragments with dimensions in excess of the layer thickness being placed, and shall be free of frozen earth, ice, snow, rubbish, peat and other unsuitable material. Borrow shall not be used in the work when suitable materials from the excavation is available.

Common borrow shall be placed in (12) twelve inch layers and be thoroughly compacted before the next layer is placed.

C. Roadway Gravel

Furnish and place gravel to a depth of fifteen (15) inches for access drives and parking areas, and to a depth equal to the depth of existing gravel base in excavation made in existing roadways. Roadway gravel to be furnished under this item shall be composed of sound durable rock together with fine material. All material shall pass a screen having a three (3) inch square opening and not more than fifty (50) percent of all material shall pass a quarter-inch (1/4) opening. The gravel shall be reasonably uniform in grading and contain not more than five (5) percent of weight of combined organic material and clay.

Gravel shall be placed in twelve (12) inch layers and be thoroughly compacted before the next layer is placed.

D. Pipe Bedding

Shall be as per BWD Standard Details

E. Trench Backfill

Shall be as per BWD Standard details.

Where flowable fill is required per the Maine Dept. of Transportation or local town standards, placement of sand or stone around pipe to a depth of 1 foot above top of pipe must occur prior to placement of flowable fill.

SECTION 5 - Hot Bituminous and Concrete Pavement

A. Description

Furnish and install bituminous surface material for the replacement of all drive, parking area, and street pavements removed to facilitate construction of the water main and appurtenances. It is the intent that removed street surfaces and pavements be reconstructed to a quality equal to or better than that which existed prior to the opening of the street for construction purposes. The completed pavement shall have a minimum thickness of three (3) inches and match the thickness of the original pavement whenever it is greater.

The bituminous material used shall conform to specifications for an acceptable mixture in accordance with the Maine State Highway Specifications for binder and wearing courses, except as modified or supplemented herein.

The bituminous surface material shall be placed in layers that will yield a finished binder course of two (2) inches and wearing course of one (1) inch, hand spread and raked, and then rolled. The wearing course shall be finished one-fourth (1/4) inch higher than the existing pavement.

During the progress of the work, the maximum distance from the point of pipe laying to the replaced binder course shall be two hundred (200) feet, unless otherwise authorized by the District. During weekends, the binder course shall be installed up the point of pipelaying.

Placement of the wearing course shall begin within three (3) days after completion of water main construction operations within the roadway.

Temporary paving with a finished minimum depth of one-and-a-half inches (1 1/2) inches shall be placed in the areas of roadway designated by the District.

In some areas of water main construction, it may be necessary to replace reinforced concrete pavement. Should the District require the replacement of reinforced concrete pavement, the Contractor shall replace disturbed areas with new concrete at least four (4) inches greater in depth than the existing concrete pavement and the new concrete surface shall be graded to match the existing surface.

B. Paving Time Limits

The Contractor shall be responsible for all conditions set forth under the City of Bangor Street Opening Permit. Under conditions of this permit, no paving shall be allowed after winter shutdown (approximately Dec. 1), and all roads must be satisfactorily paved before winter shutdown. The Contractor shall be responsible for maintaining any paving done through project duration, especially during winter shutdown.

SECTION 6 - Loam, Seeding and Sodding

A. Description

This item shall consist of furnishing and placing loam, seed, and sod as called for on the plans, or as authorized.

B. Materials

Loam: Two inches of loam shall be placed in accordance with BWD standard details. The loam shall be of an approved quality topsoil. It shall be free from gravel, roots, clods, stones, and other material, which would tend to form air pockets in the soil. The use of sour loam or mulch will not be permitted. Prior to stripping the loam, the Contractor will remove grass, briar, stumps or roots by mowing, grubbing, or other satisfactory means.

Fertilizer: Commercial fertilizer for seeding shall be 10-10-10 grade containing at least ten (10) percent available nitrogen, ten (10) percent readily available phosphoric acid and ten (10) percent total available potash. The fertilizer shall be supplied in unopened bags with the weight, contents, and guaranteed analysis shown thereon or on a securely attached bag.

Seed: All seed shall be certified as to mixture germination and purity, as being in conformity with the following requirements. All seeds shall be from the previous year's crop. Each type of seed shall have a percentage of germination not less than eighty-five (85) and shall have not more than one (1) percent weed content.

The seed mixture shall consist of seeds proportioned by weight as follows:

Kentucky Blue Grass	50%
Red Top	25%
Canada Blue Grass	10%
Dwarf White Clover	10%
English Rye Grass	5%

Sod: Sod shall, in general, be obtained from sources having soils of the same type as the base soil over which it is to be placed, except that sod from light sandy soils will not be acceptable. The sod to be placed upon sandy soils shall be of such character and moisture content that the sod will not break up or crumble during the operations of cutting, transporting, or laying. All sod shall be approved in its original location before cutting. The sod shall consist of a dense, well-rooted growth of perennial and desirable grasses, indigenous to the general locality where it is used and shall be free of noxious weeds.

Wood pegs shall have a minimum cross-section area of one (1) square inch and a minimum length of twelve (12) inches.

C. Construction Methods

1. Loam

All slopes and other areas where loam is required shall be trimmed and shaped to the required sub-grade of the area. Before placing the loam, the prepared areas shall be scarified or loosened to a depth of at least two (2) inches by harrows, pulverizers, or other means.

Loam shall be spread on the prepared areas to the uniform depth shown on the plans or as directed. After spreading, all existing lumps or clods shall be broken up and all rocks over two (2) inches in diameter, and roots, litter or foreign matter shall be raked up and disposed of. When the loamed area is to be seeded and is also adjacent to an existing lawn, all rocks over one (1) inch in size shall be removed by raking or by other approved methods, and the material shall be compacted by rolling with a suitable lawn roller. All compacted loamed surfaces shall conform to the required grades and cross sections.

When loam is spread, upon which the sod is to be placed, the material shall be spread to the required depth. Rocks exceeding two (2) inches shall be raked up, together with undesirable roots and debris, and disposed of. The loam need be only roughly shaped since in placing the sod, the material shall be adjusted to give the desired finished elevation and cross section of the sod surface. Any excess of loam remaining in stock piles, after completion of loaming all required areas, shall be trimmed or leveled to present a neat appearance as directed.

2. Fertilizing

After the areas to be seeded have been loamed and brought to grade, the soil shall be brought to a friable condition by harrowing or otherwise loosening and mixing it to a depth of at least four (4) inches before fertilizing. The commercial fertilizer shall be applied to the soil by means of a mechanical spreader or other approved method which is capable of maintaining a uniform rate of application. The fertilizer (10-10-10) shall be applied at the rate of twenty-five (25) pounds over one thousand (1,000) square feet of area. When other commercial fertilizers are used as authorized above, the application shall provide a minimum amount of the basic ingredients as specified for the 10-10-10 fertilizer. Fertilizer shall be thoroughly harrowed, raked, or otherwise mixed satisfactorily with the soil to a depth of not less than one (1) inch. Fertilizing shall be done when the soil is in a moist condition and at least twenty-four (24) hours before sowing the seed.

3. Seeding

Grass seeds of the required mixture and quality shall be sown by a mechanical seeder or other method, which will sow a uniform quantity as required over the whole area to be seeded. The mechanical seeder shall be capable of being operated to avoid the growth of grass in rows. The application of the seed shall be in the amount of three pounds per one thousand (1,000) square feet. Seeding shall be done when the air is calm, and between the dates of April 15 - October 1.

After seeding all areas shall be lightly raked by hand to mix the seed and loam, and to smooth the surface. Lawn areas shall then be rolled with a light lawn roller.

When dry periods occur during the allowable dates for seeding, the Contractor shall apply sufficient water to the area to satisfactorily maintain the moisture content of the soil to allow proper germination of the seed and growth of the grass.

4. Sodding

The sod bed or area from which the sod is to be cut shall be mowed at least twice before the sod cutting begins. Mowing shall be by means of lawn mowers or other approved equipment at intervals of one week between mowings. Cutting of sod shall not be started until at least one week after the second mowing. The sod shall be cut in strips having a minimum width of twelve (12) inches and length of not less than eighteen (18) inches. The sod shall be cut to uniform thickness of not less than two (2) inches.

The sod shall be freshly cut by means of an acceptable sod cutter and transported to the area to be sodded in an unbroken condition. Storage of sod will not be permitted and it shall be placed in final position immediately after cutting. Sod shall be loaded and unloaded by hand.

The sod shall be moist and shall be laid on a moist bed of loose loam. The sod shall be carefully placed by hand in rows at right angles to the slopes, commencing at the base of the area to be sodded and working upward.

The bottom edges of sodded areas shall extend at least two inches into the ground or ditch bottom. All other edges of sodded areas shall be turned into the ground and covered with a layer of top-soil at least two (2) inches in depth, which shall be thoroughly compacted to conduct the surface water over the edge of the sod.

The transverse joints of sod strips shall be broken and the sod carefully lain to produce tight joints. Any spaces left between sod strips shall be filled with loam. Where the sod may be displaced during sodding operation, the workmen shall work from ladders or treaded planks. The sod shall be firmly compacted by tamping with an approved tamper immediately after a workable area has been placed.

After tamping, the sod surface shall present a smooth, even surface free from bumps and depressions, and true-to-line grade and cross section. On slopes steeper than three horizontal to one vertical, the sod shall be pegged with wooden pegs. The pegs shall be spaced not more than two (2) feet apart in any direction, and shall be driven flush with the surface of the sod.

During July and August, and during periods of drought, the Contractor may place sod only if he will satisfactorily water the sod and ensure continued growth of the grasses. Sod placed during such time and not surviving shall be removed and replaced by the Contractor at his expense.

Frozen sod shall not be used, nor shall sod be placed upon frozen ground.

SECTION 7 - Permits

A Highway Opening Permit must be obtained from the City of Bangor and the Maine Dept. of Transportation before any excavation is made within the right-of-way of state, state-aid and City roads. The Contractor must obtain this permit, and the permit fees must be paid at the time of application, which will occur prior to the actual start of the work.

The contractor is responsible for signing for service from BWD and paying all applicable fees and/or deposits prior to BWD commencing work, including fire service agreements and main extension agreements.