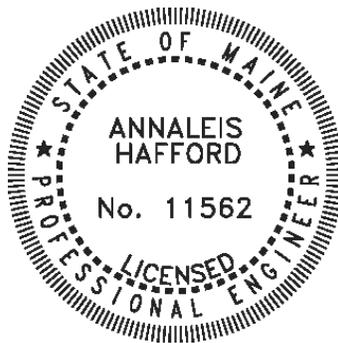


**WATER DEPARTMENT
CONSTRUCTION SPECIFICATIONS
AND STANDARD DETAILS**

**TOWN OF BAR HARBOR, MAINE
FEBRUARY, 2020**



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APPENDICES

- A. Application for Water/Sewer Service
- B. Town of Bar Harbor Road Opening Permit
- C. Terms and Conditions
- D. Guidelines for Installing Backflow Prevention Assemblies
- E. Standard Details

SECTION 1

GENERAL INFORMATION

SECTION 1 - GENERAL INFORMATION

PART 1 - INTRODUCTION

These Water System Construction Specifications and Standard Details are to be utilized as the minimum standard for all utility construction projects under the jurisdiction of the Town of Bar Harbor's Water Department (referred to as "Owner"). The purpose of this document is to present materials and practices for typical conditions encountered during utility repair or installation.

Any entities planning to perform water construction work within the Town of Bar Harbor must contact the Water Department a minimum of two weeks in advance of beginning any work. The Water Department, upon review of the proposed work, reserves the right to request any changes that it deems necessary to comply with this document or to be within its best interests. The Water Department shall issue a written response following project review. Approvals are valid for a period of two years from the date of issue. If construction is not in progress at the end of that period, approval is void. The Water Department may inspect the work periodically to ensure conformance with these Construction Specifications and Standard Details.

1.01 TERMS FOR CONDUCTING WORK

Entities needing to establish service must complete an Application for Sewer/Water Service (attached as Appendix A) and return it to the Water Department. Work must be performed in accordance with all applicable local and state regulations and best practice standards. This includes a Town of Bar Harbor Road Opening Permit (attached as Appendix B). Work is also subject to the requirements set forth in the most recently updated version of the Town of Bar Harbor's Water Department Terms and Conditions. Refer to Appendix C for a copy of this document. Appendix D provides guidelines for the installation of backflow devices and meter pits. The contractor performing the work is responsible for obtaining all permits and approvals required in order to complete the project, notifying Digsafe as well as any non-member utilities, and for coordinating with any entities affected by the work.

Large-scale water main construction projects are required to be designed by, or under the direct supervision of, a Professional Engineer licensed to practice in the State of Maine. The Engineer designing the work must review the applicable portions of these specifications to ensure that design is in accordance with the minimum standards. All distribution systems shall be capable of providing a minimum working pressure of 20 PSI under maximum day demand conditions, plus the required fire flow as determined by the Insurance Services Office (ISO) or the local Fire Department. In the event that a normal operating pressure of 20 PSI minimum cannot be met, the developer or property owner can request, in writing, limited service for each service connection. The

Water Department will determine whether adequate conditions exist to grant limited service.

All materials and equipment coming in contact with the potable water supply shall be disinfected in accordance with applicable AWWA Standards. The contractor shall be responsible for any and all costs that come as a result of poor disinfection or failing to follow best management practices. New work is subject to disinfection and testing requirements prior to activation.

Contractors are not authorized to operate any valve connected to an existing water main including, but not limited to, all domestic and fire service valves.

Any work located outside of the Right-of-Way but intended to become property of the Town of Bar Harbor will require an easement furnished by the Owner and recorded at the Registry of Deeds before service can be activated.

1.02 STANDARD DETAILS

All work shall be completed in accordance with the Water Department's Standard Details, attached as Appendix E. Work may also be subject to the requirements of other entities, such as the Town of Bar Harbor Public Works Department or the Maine Department of Transportation (MDOT).

The Standard Details include, but are not limited to, the following:

- Meters and Backflows
- Service Connections
- Blow-off Assemblies
- Hydrant Assemblies
- Typical Water Main Trench and Surface Restoration
- Water Valves and Valve Boxes
- Thrust Block Arrangements

1.03 DEVIATIONS AND SPECIALTY ITEMS

Items not included within the scope of this document must be reviewed in advance with the Town of Bar Harbor's Water Department prior to any work beginning. Approval of such items shall be at the sole discretion of the Water Department and will be considered on a case-by-case basis.

1.04 INTERRUPTIONS IN SERVICE

Any entities planning a water service interruption as part of construction work must contact the Water Department at least two weeks in advance before beginning any work. Provide the Water Department a draft notice including the following information:

- Start date and time and anticipated duration of the interruption to service.
- Names and phone numbers of project contacts.

The final schedule of the service interruption is subject to the approval of the Water Department. The Water Department will make notifications to affected customers in accordance with its Terms and Conditions or may direct the contractor to make the notifications.

In the event of unplanned water service interruptions, the Water Department is to be contacted immediately.

1.05 RECORD DRAWINGS

Contractors are required to submit Record Drawings to the Town of Bar Harbor Water Department following completion of work. Record drawings must include swing-ties to all features including valves, service boxes, tees, reducers, and fittings; sketches including detailed measurements for any adapter type fitting for all lateral connections, sketches of all utility crossings, location and degree of bends, and depth measurements taken every 100 feet or at significant changes in depth along the installation.

*** END OF SECTION ***

SECTION 2

EARTHWORK

SECTION 2 - EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Earthwork includes the following:

1. Excavation of soils, rock, debris, fill, and miscellaneous as required.
2. Excavation and sawcutting of paved areas.
3. Dewatering, drainage, and moisture control in excavated areas as required.
4. Aggregates for fill, backfill, base, subbase, bedding, drainage, riprap and miscellaneous as required.
5. Backfilling of trench, roadway, and structural excavation.
6. Compaction of trench, roadway, and structural excavation.
7. Grading of areas prior to surface restoration.
8. Disposal of excess material.
9. Test pits as required.
10. Filter fabric and jute mat where required.
11. Trench marking tape where required.
12. Flowable fill as required in areas where rapid backfilling is needed or where adjacent slabs or structures have been undermined by excavation.
13. Roadway reclamation.

1.02 RELATED SECTIONS

- A. Section 3 - Water Distribution Systems.
- B. Section 4 - Hot Bituminous Paving.
- C. Section 5 - Lawns and Grasses.
- D. Section 6 – Cast-in-Place Concrete.

1.03 DEFINITIONS

- A. Base Course: The layer placed above the subbase.
- B. Common Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavation.
- C. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.
- D. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- E. Subbase Course: The layer placed between the subgrade and base course.
- F. Subgrade: The uppermost surface of an excavation or the top surface of a fill on backfill at elevations defined on the Drawings.
- G. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner. Unauthorized excavation, as well as remedial work directed by the Owner, shall be at the Contractor's expense.
- H. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.

1.05 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.
 - 1. Provide a minimum 72 hours notice to the Owner and receive written notice to proceed before interrupting any utility.
- B. Demolish and abandon existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.
- C. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data is made available for convenience of Contractor who may make additional subsurface explorations at his/her own cost to obtain additional data on subsurface conditions.
- D. Test pits: Excavate test pits to gain additional information on project conditions where shown on the Drawings or as directed by Owner. Comply with earthwork requirements of this Section.

1.06 PROTECTION

- A. Protection of surfaces: Do not operate equipment on surfaces beyond the work area as much as practicable. Surfaces which are outside the specified limits of Work which become damaged shall be repaired by the Contractor at no additional cost to the Owner.
- B. Maintain excavations with approved barricades, lights, and signs to protect life and property until excavation is filled and graded to a condition acceptable to the Owner.
- C. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. Provide approved soil materials complying with this specification.
- B. Suitable materials: As directed by Owner or that meet these specifications.
- C. Unsuitable materials: Material containing excessive clay, vegetation, organic matter; debris; pavement over four inches in greatest dimension; stones or boulders over four inches in greatest dimension; frozen material and material which, in the opinion of the Owner, will not provide a suitable foundation or subgrade, or does not meet these specifications.
- D. On-Site Suitable Excess Excavated Material: Any suitable material from on-site excavation which, in the opinion of Owner, is acceptable for roadway subgrade or embankment construction.
- E. Inspection: The Owner may inspect off-site sources of materials and order tests of these materials to verify compliance with these specifications.

2.02 Gravel/Select Backfill: Well graded granular material free of organic material. Sieve analysis by weight:

<u>Sieve size</u>	<u>% Passing By Weight</u>
4"	100
3"	90 - 100
1/4"	25 - 90
No. 40	0 - 30
No. 200	0 - 5

2.03 Sand: Well graded durable particles free from organic matter. Sieve analysis by weight:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
3/8"	100
No. 4	95 - 100
No. 16	50 - 85
No. 100	2 - 10
No. 200	0 - 5

2.04 3/4" Crushed Stone: Durable, clean angular rock fragments obtained by breaking and crushing rock material. Sieve analysis by weight:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
1"	100
3/4"	75 - 100
1/2"	35 - 70
3/8"	0 - 25
No. 200	0 - 2

2.05 Flowable Fill:

- A. Type II Portland: Cement, 75 lbs per cubic yard.
- B. Sand: 2350 lbs per cubic yard.
- C. Air content: -25%.

2.06 Aggregate Base: Shall be screened or crushed gravel of hard durable particles free from organic material. Sieve analysis by weight:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
3"	100
1/2"	35 - 75
1/4"	25 - 60
No. 40	0 - 25
No. 200	0 - 5

2.07 Aggregate Subbase: Shall be screened or crushed gravel of hard durable particles free from organic material. Sieve analysis by weight:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
6"	100
3"	95 - 100
1/4"	25 - 70
No. 40	0 - 30
No. 200	0 - 5

2.08 Leveling course and untreated surface course: Shall be screened or crushed gravel of hard durable particles free from organic materials. Sieve analysis by weight:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
1"	95 - 100
3/4"	90 - 100
No. 4	40 - 65
No. 10	10 - 45
No. 200	0 - 5

2.09 Riprap: Sound, durable, angular rock which will not disintegrate by exposure to water or weather. Rough quarry stone or blasted ledge rock, with a mean diameter (d50) of 18" shall be provided. All stones shall be less than or equal to 24" in diameter, with a well graded mixture composed primarily of larger sized stones, but with a sufficient mixture of smaller stones to fill void spaces.

2.10 Common Borrow: Earth suitable for embankment or subgrade construction shall be free of frozen material, rubbish, debris, peat and other unsuitable material. Soils meeting Soil Classifications MH, CH, OH, and Pt will not be accepted. Moisture content shall be sufficient to provide required compaction and stable embankment. In no case shall the moisture content exceed 4 percent above optimum. The optimum moisture content shall be determined in accordance with ASTM 1557. All common borrow material shall be approved by Engineer. Sieve analysis by weight:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
8"	100
No. 200	0 - 50

2.11 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 3 inches wide and 5 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 2'-6" deep.

B. Tape Colors: Provide tape colors to utilities as follows:

1. Red: Electric.

2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.
- C. Filter Fabric for General Use: Manufacturer's standard nonwoven pervious geotextile fabric of polypropylene, nylon or polyester fibers, or a combination.
1. Provide filter fabrics that meets or exceeds the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method in parenthesis:
 - a) Grab Tensile Strength (ASTM D 4632): 120 lb.
 - b) Apparent Opening Size (ASTM D 4751): #70 U.S. Standard sieve.
 - c) Permittivity (ASTM D 4491): 1.7 per second.
 - d) Flow rate (ASTM D 4491): 135 gallons per minute per square foot.
 2. Fabric shall be equal to MIRAFI 140N manufactured by T.C. MIRAFI.
- D. Filter Fabric for Roadways: Manufacturer's standard woven pervious geotextile fabric of polypropylene, nylon or polyester fibers, or a combination.
1. Provide filter fabrics that meets or exceeds the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method in parenthesis:
 - a) Grab Tensile Strength (ASTM D 4632): 200 lb.
 - b) Apparent Opening Size (ASTM D 4751): #40 U.S. Standard sieve.
 - c) Permittivity (ASTM D 4491): 0.05 per second.
 - d) Flow rate (ASTM D 4491): 4 gallons per minute per square foot.
 2. Fabric shall be equal to MIRAFI 500X manufactured by T.C. MIRAFI

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, tanks, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- D. Provide tree protection as required.
- E. Obtain copies of all applicable permits governing excavation.

3.02 EXCAVATION CLASSIFICATIONS

- A. Excavation is classified as follows and includes excavation to required subgrade elevations. Excavation will be classified as earth excavation or rock excavation on land and as submerged excavation or submerged rock excavation below mean low water of tidal areas as follows:
 - 1. Earth excavation includes roadway excavation of pavements, bases, subbases and subgrades, and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with soil and other materials encountered that are not classified as rock or unauthorized excavation.
 - a) Intermittent drilling, blasting, or ripping to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.
 - 2. Rock excavation includes removal and disposal of rock material and obstructions encountered that cannot be removed by the following heavy-duty rock excavating equipment without systematic drilling, blasting, or ripping.

- a) Rock material includes boulders 2.0 cubic yards or more in volume and rock in beds, ledges, unstratified masses, and conglomerate deposits.

3.03 STABILITY OF EXCAVATIONS

- A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

3.04 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.
- D. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Appurtenances: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot. Do not disturb bottom of excavations intended for bearing surface.

3.05 ROADWAY AND WALKWAY EXCAVATION

- A. Prior to beginning excavating, grading, and embankment operations in any areas, all necessary clearing in that area shall have been completed.
- B. Suitable material taken from excavation shall be used in the construction of embankment, subgrade, and for backfilling as indicated on the plans, or as directed, except that if the volume of suitable excavated material exceeds that required to construct the embankments to the grades indicated, the excess shall be wasted as directed.
- C. The Owner may designate as unsuitable those soils which cannot be properly compacted in embankment or which contain undesirable materials or debris, and all such unsuitable material shall be disposed of in approved waste storage areas.
- D. Unsuitable material shall be disposed of as directed and no material shall be wasted without permission.
- E. Excavating operations shall be conducted so that material outside of the limits of slopes will not be disturbed.

- F. No common excavation, rock excavation, unclassified excavation or borrow which is designated for use in embankments or backfill may be diverted for the Contractor's own use. Any unauthorized use of such material will be adjusted by deducting quantities, measured by the most appropriate method, as determined, and 115 percent of the quantity deducted from the total amount.
- G. The Contractor shall not excavate beyond the dimensions, slopes and elevations established, and no material shall be removed prior to the staking out and cross sectioning of the site.
- H. Unless otherwise authorized, borrow material shall not be placed until after all suitable excess excavation has been placed in the embankment or subgrade unless the use of granular borrow is called for on the plans or required for use under embankments or in conjunction with the use of excavated material or for the maintenance of traffic. If the Contractor places more borrow than is required and thereby causes a need to waste suitable excavation material, the amount of such waste will be measured by the method deemed most appropriate and 115 percent of the amount will be deducted from the borrow volume.
- I. When it is necessary to temporarily remove fencing designated to remain, the fencing shall be replaced by the Contractor at his expense in as good a condition as it was originally.
- J. Excavating for obliterating old roadways or salvaging material from old roadways shall include all grading operations necessary to incorporate the old roadway into the new roadway and surroundings or placing salvaged material in a stockpile as directed.
- K. The degree of finish for grading ditches and slopes, both fill slopes and cut slopes, shall be that obtainable from machine operations. Ditches shall be constructed to within 6 inches above or below the grade called for on the cross sections or as otherwise modified but in no case shall the ditch be finished in a condition that will not allow the flow of water. Ditches shall be graded to the extent that puddles will not form.
- L. Unstable slopes subject to sliding and slumping shall be excavated to the lines and grades shown or as directed. Immediately after each location is excavated, approved stone or granular slope blanket backfill material shall be placed and shaped to match the adjacent slopes.

- M. Ledge slopes shall be cleaned of all loose material immediately as the excavation proceeds. Immediate steps shall be taken by the Contractor to insure the stability of the slope during construction.
- N. Roadway excavation shall be maintained in such condition that the excavation surface will be well drained. Temporary drains, drainage ditches and culverts shall be constructed to intercept and divert water which may adversely affect the condition of the excavation and the prosecution of the work.
- O. Excavation shall proceed in a direction upgrade.
- P. Subgrades shall be promptly graded and rolled to minimize absorption of water.
- Q. Adjacent ditches shall be graded to the extent that puddles will not form.
- R. Grubbing areas which cannot be drained shall be promptly filled with approved excavation or borrow to such an elevation that surface drainage will be effective.
- S. Muck shall be removed in such a manner to insure its complete removal with no areas remaining or trapped below the embankment.
- T. Excavation adjacent to roots of trees or shrubs which are to remain shall be removed by hand.
- U. When excavating results in a subgrade of unsuitable soil, the Owner may require the Contractor to remove the unsuitable material and backfill the area with approved material.

3.06 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated slopes, lines, depths, and invert elevations.
- B. Excavate uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: 12 inches each side of pipe or conduit or as indicated on Drawings.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit or appropriate space for bedding where bedding is required as indicated on Drawings.

- D. Remove all sharp items and objects from trench.
- E. Where encountering rock or another unyielding bearing surface, carry trench excavation 6 inches below invert elevation to receive bedding course.
- F. Maximum excavated length of utility trench that may be left open and not backfilled to grade shall at end of day be 200 LF.

3.07 EXCAVATION OF PAVED AREAS

- A. Sawcut pavement prior to excavation and again prior to paving to provide a clean, uniform edge.
- B. Minimize disturbance of remaining pavement.
- C. Cut and remove the minimum amount of pavement required to do the Work.
- D. Use shoring and bracing where sides of excavation will not stand without undermining pavement.

3.08 EXCESS EXCAVATION WASTE AREAS

- A. If material is suitable as approved by Owner, use excess excavated material for subgrade or embankment construction. Comply with all compaction requirements defined herein.
- B. If material is deemed unsuitable for reuse by Owner, or if excess suitable material exists, it shall be the responsibility of the Contractor to obtain necessary permits and approvals from all pertinent State and Federal prior to the establishment of waste areas off the project.
 - 1. Written permission of the property owners shall be obtained by the Contractor, including permission to dispose of waste in the area.
 - 2. Copies of all required permits shall be kept on the jobsite.
 - 3. Provisions shall be made for temporary and permanent erosion controls at waste areas which shall include, but not necessarily be limited to, grading the surface to drain, covering the surface with loam or other earthy material that will support growth and seeding and mulching.

3.09 TEST PITS

- A. Excavate test pits in locations as directed by Owner.
- B. Utilize smallest equipment required for excavation and appropriately tracked or wheeled equipment to minimize damage to ground surfaces and vegetation in areas not otherwise to be disturbed by Contractor's activities.
- C. To the extent possible, restore surface conditions to existing prior to excavation.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.
- B. Stockpile soil materials away from edge of excavation. Do not store within drip line of remaining trees.
- C. Stockpiling excavated soils along roadway is prohibited.

3.11 DEWATERING

- A. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- C. Do not allow water to accumulate in excavations. Provide and maintain pumps, dewatering system components necessary to convey water away from excavations.
- D. Convey water removed from excavations and rain water to collection or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

3.12 BACKFILL AND FILL

- A. Place acceptable soil material in layers to required elevations as shown on the Drawings and as listed below.
- B. Fill, backfill, and compact to produce minimum subsequent settlement of the material and provide adequate support for the surface treatment or structure to be placed on the material.
- C. Place material in approximately horizontal layers of beginning at lowest area to be filled. Do not impair drainage.
- D. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Scarify surfaces so that fill material will bond with existing surface.
- E. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.
- F. Place backfill and fill materials in layers not more than 12" in loose depth for material compacted by heavy compaction equipment, and not more than 6" in loose depth for material compacted by hand-operated tampers. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- G. Place backfill and fill materials evenly adjacent to structures, to required elevations. Prevent wedging action of backfill against structures by carrying material uniformly around structure to approximately same elevation in each lift. No backfill shall be placed around new concrete structures until concrete has reached 75% of its design strength.
- H. Do not allow heavy machinery within five feet of structures during backfilling and compaction.
- I. Backfill excavations as promptly as Work permits, but not until completion of the following:
 - 1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for record documents.

3. Testing, inspecting, and approval of underground utilities.
 4. Concrete formwork removal.
 5. Removal of trash and debris from excavation.
 6. Removal of temporary shoring and bracing, and sheeting.
 7. Where sheeting is to remain, cut off temporary piling drain below bottom of structures and remove in a manner to prevent settlement of structure or utility, or leave in place.
 8. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- J. Use care in backfilling to avoid damage or displacement of underground structures and pipe.
- K. Backfill under all existing utility pipes crossed by sewer construction with 3/4" crushed stone or flowable fill. The crushed stone backfill will extend continuously from the bedding of the new sewer to the utility pipe crossed, including a 6" thick envelope of crushed stone all around the existing utility pipes. The 3/4" crushed stone backfill shall stand at its own angle of repose. No "haunching" or "forming" with common fill will be allowed.

3.13 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on rock and other unyielding bearing surfaces and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Bed pipe in crushed stone to limits of bedding and requirements for remaining trench backfill.
- C. Trenches in cross-country runs: Restore surface to the existing prior to construction. Mound trench 6 inches above existing grade if required by the Owner.
- D. Concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches of footings. Place concrete to level of bottom of footings.

- E. Provide 4 inch thick concrete base slab support for piping or conduit less than 2'-6" below surface of roadways. After installation and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- F. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit.
- G. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- H. Coordinate backfilling with utilities testing.
- I. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.
- J. Place and compact final backfill of satisfactory soil material to final subgrade.
- K. Install warning tape directly above utilities as indicated on Drawings.

3.14 COMPACTION

- A. Place backfill and fill materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.
- C. Compact to the following minimum densities:

<u>FILL AND BACKFILL LOCATION</u>	<u>DENSITY</u>
Top 2 feet under gravel roadway	95%
Top 2 feet under pavement	95%
Below top 2 feet under pavement	92%
Trenches through unpaved areas	90%
Pipe Bedding	92%

Under structure foundations	95%
Beside structure foundation walls, retaining walls, and tank walls	95%
Around street manholes, catchbasins and wet wells	92%
Maximum density:	ASTM D1557, modified.
Field density tests: ASTM D2922 (nuclear methods).	

- I. In each compacted initial and final trench backfill layer, perform at least one field in-place density test for each 200 feet or less of trench, and at every 2' vertical layer, but no fewer than two tests.
- J. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact, and retest until required density is obtained.

3.15 GRADING

- A. Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Provide a smooth transition between existing adjacent grades and new grades.
- C. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.
- D. Slope grades to direct water away from buildings and to prevent ponding.
- E. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 0.10 foot.
 - 2. Walks: Plus or minus 0.10 foot.
 - 3. Pavements: Plus or minus 1/2 inch when tested with 10 foot straightedge.
- F. After grading, compact subgrade surfaces to the percentage of maximum density for each area classification.
- G. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

- H. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- I. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

3.16 SUBBASE AND BASE COURSES

- A. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbases to pavements.
- B. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 95 percent of ASTM D 1557 modified.
- C. Shape subbase and base to required crown elevations and cross-slope grades.
- D. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
- E. When thickness of compacted subbase or base course exceeds 12 inches, place materials in equal layers, with no layer more than 12 inches thick or less than 6 inches thick when compacted.
- F. Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders at least 12 inches wide of acceptable soil materials and compact simultaneously with each subbase and base layer.

3.17 FINAL DISPOSAL OF EXCESS MATERIALS

- A. Remove excess excavated material not wanted by the Owner and dispose of it off Owner's property.
- B. Grade material to the satisfaction of the Owner of the property on which the material is deposited. Keep roads free of debris. Use suitable watertight vehicles for hauling wet materials over roads and streets.
- C. Clean up materials dropped from or spread by vehicles promptly or when directed by the Owner.

D. Dispose of materials in accordance with all applicable regulations.

END OF SECTION

SECTION 3

WATER DISTRIBUTION SYSTEMS

SECTION 3 - WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. General: This section includes:

1. Water main relocation or special crossings where encountered.
2. Water service relocation where encountered at-grade.
3. Materials required for repair of water services which are damaged in course of work.
4. Yard hydrant and service piping.
5. Ductile iron water main.
6. CTS PE water main.
7. CTS PE well line.
8. Water line fittings and adapters.
9. Water services to buildings.
10. Water wedge valves.
11. Corporation stops.
12. Saddles for large corporation stops.
13. Curb stops.
14. Valve boxes.
15. Hydrants.
16. DR 11 HDPE water main.
17. Tapping sleeve.

18. Temporary water service.

1.02 RELATED SECTIONS

A. Section 2 - Earthwork.

1.03 PERFORMANCE REQUIREMENTS

A. Water Main Pressure Ratings: Not less than 1.5 times the sustained working pressure of the lowest elevation of the test section.

1.04 QUALITY ASSURANCE

A. For water line work, comply with all requirements of the Owner. All materials and workmanship are subject to approval by the Owner.

B. Perform all water line relocation work in accordance with Department of Health and Human Services standards, where more stringent than local requirements.

C. All work including temporary water service shall comply with American Water Works Association and NSF/ANSI Standards for Drinking Water.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare hydrants for transport as follows:

1. Ensure that hydrants are dry and internally protected against rust and corrosion.

2. Protect against damage to threaded ends, flange faces, and weld ends.

3. Set in best position for handling.

B. Storage: Use the following precautions for hydrants during storage:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.

2. Protect from weather. Store indoors and maintain temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support off the ground or pavement in watertight enclosures.

C. Use the following precautions for pipes during storage:

1. All materials shall be kept safe from damage. Materials shall be kept free from dirt and foreign materials at all times.
2. Store gaskets in cool location out of direct sunlight. Gaskets should not come in contact with petroleum products.
3. Protect from moisture and dirt.

1.06 SEQUENCING AND SCHEDULING

A. Coordinate relocation of water main with Owner as necessary.

PART 2 - PRODUCTS

2.01 BURIED PIPES AND TUBES

- A. All piping, fittings, valves, coating, gaskets and appurtenances that will come into contact with potable water shall have ANSI/NSF Standard 61 Certification.
- B. General: Provide fittings and other required piping accessories of same type and class of material as conduit, or of material having equal or superior physical and chemical properties.
- C. Ductile-Iron Pipe: AWWA C151, thickness Class 52.
 1. Lining: AWWA C104, cement mortar, seal coated.
 2. Gaskets, Glands, and Bolts and Nuts: AWWA C111.
 3. Mechanical-Joint-Type or Push-On Type Pipe: AWWA C111, rubber gaskets, ductile iron glands, and stainless steel bolts and nuts.
 4. Exterior Coating: Bituminous.
- D. Copper Tube:
 1. ASTM B 88 (ASTM B 88M), seamless water tube, Type K annealed temper.

E. CTS PE Plastic Pipe for Water Service:

1. ASTM D 2737, of PE compound.
2. Minimum pressure rating 200 psi.
3. Include marking “NSF-pw” according to NSF 14.
4. Conform with AWWA C 901.
5. Provide longest coil length available to minimize the number of joints.
6. Insert stiffeners are required at all compression connections for leak-free installation.
7. Provide compression fittings.
8. Provide tracer wire over all non-metallic pipes.

F. Extra High Molecular Weight Polyethylene Pipe (EHMW PE):

1. ASTM D 1248 Type III, Class C, Category 5, Grade P34 polyethylene pipe material.
4. Pressure rating as follows:

<u>SDR/DR</u>	<u>PSI</u>
9.0	200
11.0	160

5. Include blue stripe marking “NSFpw” approved for potable water use according to NSF-14.
6. Pipe density 0.955 g/cm³ per ASTM D 1505.
7. Melt index 0.10 g/10 min per ASTM D 1238.
8. Flexural modulus 133,000 psi per ASTM D 790.
9. Tensile strength 3200-3500 psi per ASTM D 638.

10. Hydrostatic design basis 800 psi at 140°F.
11. Resistance to distortion up to 180°F.
12. Protection from ultraviolet sunlight degradation by adding 2 to 3% finely divided carbon black compound.
13. Above ground service rated.
14. Chemical corrosion resistant at all pH ranges.
15. Provide tracer wire over all non-metallic pipes.
16. Equal to CPChem Performance Pipe EMHW PW 3408 by Chevron Chemical Co., Bensenville, Illinois.

2.02 PIPE AND TUBE FITTINGS

- A. Ductile Iron Pipe Fittings: AWWA C110, ductile iron, 250 psig (1725 kPa) minimum pressure rating.
- B. Copper Fittings: Mueller compression type IPS connections, or equal. Pack joints shall not be allowed.
- C. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300, as required for system operating pressure.
- D. Molded, PE Plastic Fittings: PE resin, Butt-fusion type, made to match PE pipe ASTM, pressure ratings, SDR, dimensions and class.

2.03 JOINING MATERIALS

- A. Ductile Iron Pipe and PVC Pipe: The following materials apply:
 1. Mechanical Joints: Meets or exceeds AWWA C-219, NSF 61, NSF 372, ductile iron casting, high strength stainless steel bolts, washers and nuts, and rubber gaskets.
- B. Gaskets: EPDM Rubber.
- C. End Rings: Ductile Iron Casting ASTM A536, Grade 60-40-18.

- D. Center Ring: Ductile Cast Iron Casting ASTM A536 Grade 65-45-12 with handle.
- E. Grip Chain: Gripping Teeth: Size 4.0” – 12” (AISI 420 LB or AISI 440C).
- F. Bridge: AISI 304 Stainless Steel.
- G. Spherical Spacers: AISI 304 Stainless Steel.
- H. Coating: 100% fusion bonded epoxy.
- I. Bolts, Washers and Nuts: AISI 304 Stainless Steel.
- J. Equal to: Hymax Grip Coupling.
- K. Products with set screw grips not allowed.

2.04 VALVES

A. Tapping water mains:

1. CC x CPPJ for tapping into ductile iron water mains or electrofusion coupling for HDPE water mains.
2. Ball valve with PTFE coated bronze ball.
3. Meeting NSF 61.
4. 300 psi rating at maximum working pressure.
5. Insert stiffeners of stainless steel construction required at all connections to flexible tubing.
6. Size to match water service lines.

B. Saddles for Large Service Lines for Ductile Iron water mains:

1. Service lines greater than 1” Ø shall be connected to the water main with a service saddle.
2. Corporation stop shall be threaded into saddle.

3. Saddle shall be double strap style. (Single strap saddles shall be unacceptable).
4. Body shall be ductile iron, Grade 65-45-12, meeting ASTM A-536.
5. Threads shall be FEP or CC (AWWA).
6. Finish shall be shop coat paint.
7. Fasteners shall be 304 stainless steel.
8. Gaskets shall be virgin NBR rated for water service.
9. Straps shall be 304 stainless steel.
10. Smith-Blair, or equal.

C. Saddles for Large Service Lines for HDPE water mains:

Provide electrofusion saddles manufactured in accordance with ASTM F-1055 and conform with the following material requirements:

1. Pre-Blended resin 4710 which complies with ASTM D3350.
2. Resin must be acceptable for use with potable water and comply with NSF Standard 61.
3. CC threads.

D. Curb Stop, Service Box, and Rod:

1. CPPJ X CPPJ fittings.
2. Ball valve with PTFE coated ball.
3. Meeting AWWA C-800 and NSF 61.
4. 300 psi rating at maximum working pressure.
5. Body shall be heavy duty lead free brass.
6. Requires two O-ring seals in precision grooves.

7. Insert stiffeners of stainless steel construction required at all connections to flexible tubing.
8. Curb stop equal to Mueller Series 300.
9. Service box shall be 1" I.D. #40 black steel with top having N.P.I. threads for 1" screw-on cover, Erie Style with 5' to 6' slide-type riser.
10. Foot pieces shall be heavy duty, Ford style or equal cast iron design. Foot piece shall have arch to fit over 2" ball valve curb stops.
11. Service rod shall be 1/2" minimum diameter 304 stainless steel, and minimum of three feet in length.
12. The curb stop attachment point shall be a brass or stainless steel cotter pin.
13. The rod yoke shall be an integral part of the rod and the wrench flat shall have a minimum thickness of 1/4" tapered to 1/10" and a width of 5/8" or 1/2".
14. Caps shall be 1" extra heavy with brass pentagon plug and coarse "rope" thread to fit 1" service box.
15. All caps shall have the word "WATER" clearly cast in top and be constructed of a magnetic material.
16. Clow, or approved equal.

E. Resilient Wedge Valves:

1. Comply with AWWA C515.
2. Acceptable manufacturers are American Flow, Clow, Mueller, or AVK.
3. Working pressure 250 psi.
4. Test pressure 400 psi.
5. Wedge shall be ductile iron encapsulated in urethane rubber bonded permanently to meet ASTM D429.

6. Stems shall be epoxy coated stainless steel with integral thrust collar.
7. Two O-ring seals shall be provided above thrust collar and be replaceable with valve fully open under rated working pressure.
8. Two thrust washers shall be located above and below stem collar to reduce torque.
9. Actuator stem nut shall be ductile iron.
10. Actuator nut shall be held onto valve with removable nut. Stainless steel punchout pins or hex nuts shall not be acceptable.
11. All bolts shall be Type 18-8 stainless steel.
12. Valve type shall be MJ x MJ or MJ x Tapping unless other connection type required in-field.
13. UL and FM approved.

F. Valve Boxes:

1. Ductile iron, two piece sliding type with bell-type base.
2. Top flange and minimum 5 1/4" inside diameter.
3. Box cover shall be 2" drop-type cover to fit 5 1/4" opening.
4. Variable length bottom section and 2' top section.
5. Lettering "WATER".
6. Interior and exterior of all components shall be coated with bituminous.

2.05 HYDRANTS

- A. Equal to Clow Eddy F-2641. (Non-self draining)
- B. Meeting AWWA C-502-85.
- C. Body shall be cast iron with ductile iron cap nut.

- D. Breakoff flange at bottom.
- E. Compression type hydrant with main valve closing under water pressure.
- F. Rising stem to indicate open/close position.
- G. Valve opening 5 1/4”.
- H. O-ring seals at stem.
- I. Plugged drain required.
- J. Two hose nozzles at 2 1/2” with NSF threads. Confirm nozzle size with local fire department and water company.
- K. One pumper nozzle with 5” Storz connection shall be provided in front of hydrant. Confirm nozzle size with Town of Bar Harbor.
- L. Galvanized chain on nozzles.
- M. Opens left.
- N. Exterior finish: Red alkyd-gloss enamel paint.
- O. Valves to comply with above wedge valve specification.
- P. All fasteners shall be 304 SS and all interior rubber components shall be EPDM Rubber.
- Q. Check valve shall be ductile iron ASTM Standard A536 with NSF approved fusion bonded epoxy coating (interior/exterior).

2.06 TAPPING SLEEVE

- A. Tapping sleeve shall be 316 SS with full circumferential seal, rated for 250 psi.

2.07 YARD HYDRANT

- A. Eclipse #2 Post Hydrant with 2” inlet and 2 3/16” valve opening and 1 1/2” outlet, or equal. (Hydrant must be non-self draining).

2.08 ANCHORAGES

- A. Clamps, Straps, and Washers: Stainless steel.
- B. Rods: Stainless steel.
- C. Rod Couplings: Stainless steel.
- D. Bolts: Stainless steel.
- E. Washers: Stainless steel.
- F. Pipe Lubricant: Suitable for use in potable water supply.

2.09 LIVE INSERTION TAPPING VALVES

- A. Valve shall be equal to Romac Quickvalve insertion valve.
- B. Comply with AWWA.
- C. Tapping sleeve shall provide 360° seal around pipe under working pressure up to 150 psi without interruption in water service. Sleeve shall be constructed of ASTM A-36 steel with epoxy coating 10-12 mils.
 - 1. Flange: a special flange shall be used that mates with installation equipment and insertion valve.
 - 2. Neck: the neck shall be manufactured to precision tolerances that assure proper alignment, support and sealing of the Quikvalve insert.
 - 3. Bolts and nuts: 304SS bolts with SDC nuts.
 - 4. Gaskets: SBR for potable water in accordance with ASTM D2000 Standards. Gaskets shall provide a positive 360° seal on the pipe and assure a tight, durable and resilient seal at the pipe sleeve-valve insert junction.
 - 5. Coating: sleeve shall be lined and coated with fusion bonded epoxy meeting AWWA-C213 and ANSI/NSF 61 Standards.
 - 6. Armors: heavy gauge 304 SS armor plates are used to bridge the gap between sleeve halves.

7. Lugs: configured to properly align the sleeve halves during installation, provide a bolting surface, and assure a 360° seal.

D. The valve assembly is a water control device and shutoff when installed in a valve tapping sleeve. The valve is installed in an open position under water pressure without any interruption of service. The valve shall provide full unobstructed full flow waterway after installation.

1. Insert: ductile iron casting coated with SBR rubber for potable water service with 55 durometer.

2. Valve stem and nut: AWWA C-500-80.

3. Flange: ASTM A-36 steel flange is used to hold the valve assembly together and act as a seal against the valve sleeve flange.

4. Gasket: SBR rubber for potable water service, ASTM D2000, 70 durometer. The gasket acts as the sealing interface between the valve flange and sleeve flange.

5. Bolts and nuts: 304 SS.

2.10 SEASONAL METER ENCLOSURE

A. Jumbo Plastic 18" x 12" or as required by Town.

B. By F.W. Webb or Maine Water Works.

2.11 METER PITS AND ENCLOSURES

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable.

- B. Structures: Portland-cement design mix, 3000 psi minimum at 28 days, with 0.45 maximum water-cement ratio.
 - 1. Reinforced Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A 615, Grade 60 (ASTM A 615M, Grade 400), deformed steel.
- C. Structure Channels and Benches: Factory or field formed from concrete. Portland-cement design mix, 3000 psi minimum, with 0.45 maximum water-cement ratio.
- D. Precast Concrete Structures: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasket joints meeting AASHTO H-20 loading.
- E. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
- F. Base Section: Minimum thickness for floor slab, as shown on plans, and minimum thickness for walls and base riser section, as shown on plans, and having a separate base slab or base section with integral floor.
- G. Riser Sections: Minimum thickness, as shown on plans, 48-inch minimum diameter, or as shown on plans, and lengths to provide depth indicated.
- H. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
- I. Sealants: ASTM C 443 butyl rubber, two rings sealant around each joint for watertight connection.
- J. Steps: Provide steps for manholes greater than four feet deep.
 - 1. ASTM C 478 individual steps or ladder.
 - 2. Aluminum alloy 6061-T6 or copolymer polypropylene plastic with 1/2" Grade 60 reinforcing bar meeting ASTM D4101 Type II and ASTM A 615.
 - 3. Meet all OSHA requirements.

4. Minimum width 14”.
5. Maximum spacing 12” on center.
6. Coat with bitumastic paint where cast in concrete.

K. Pipe Penetrations:

1. Non-pressure pipes and drains: Flexible manhole sleeves equal to CP series manufactured by Interpace Corp. size to fit diameter and type of pipe without use of gaskets.
2. Pressure pipes: Flexible Manhole sleeves as above or, thermoplastic pipe sleeve equal to "Link-Seal Century Line" model CS100 by Thunderline Corp. with sleeve seal equal to "Link-Seal" by Thunderline Corp.
3. As specified on drawings if in conflict with above.

2.12 PROTECTIVE COATINGS

- A. Include factory or field applied protective coatings to structures and appurtenances according to the following:
1. Coating: Two coats, coal-tar epoxy, bitumastic, or Conseal coating, each coat 15 mil minimum thickness, except where otherwise indicated.
 2. Structures: On exterior surface, bitumastic, PPS 922 superseal or equal.

2.13 RISER RINGS TO GRADE

- A. Provide reinforced riser rings to grade.
- B. Use number of rings required to achieve grade elevation.
- C. Seal all joints with bitumastic sealant.
- D. Ring inside diameter shall be twenty-four inches.

2.14 WATERTIGHT FRAME AND COVER

- A. Fully machined bolted cover with Stainless Steel bolts.
- B. Two rings for watertight seal, as follows:
 - 1. Elastomer sealing ring.
 - 2. Rubber seating ring fastened by 6 bolts and clamping claws.
- C. Ductile Iron construction meeting Class D400 EN124, H20, and AASHTO loading criteria.
- D. Minimum clear frame opening: 24”.
- E. Frame height: 4”.
- G. Equal to Pamtight Ductile Iron frame and cover.

2.15 FROST BARRIERS

- A. Frost Barrier: U.V. Resistant, high grade polyethylene, minimum 6 mils thick.

2.16 MORTAR MATERIALS

- A. For mortar mix: Conform to requirements of ASTM C 270, Type S using Portland cement.
- B. Portland Cement: Natural color ASTM C 150, Type I, except Type III may be used for cold weather construction.
- C. Hydrated Lime: ASTM C270, Type S.

2.17 ABOVE GRADE ENCLOSURES

- A. Prefabricated above grade enclosures equipped with heat, gravity drainage, and removable access panels.
- B. Equal to Hot Box.
- C. Coordinate location with Water Department.

PART 3 - EXECUTION

3.01 PIPE

- A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation for all buried pipes.
- B. Remove unstable, soft, and unsuitable materials at trench bottom upon which pipes are to be laid and filled with compacted select backfill.
- C. Bedding for ductile iron pipe shall be gravel or native material as approved by Owner from 6 inches below to 6 inches above pipe.
- D. Ductile-Iron Pipe: Install with cement mortar lined mechanical joint and retainer glands or push on joint fittings and rubber gaskets in accordance with AWWA C600.
- E. Clean interior of pipe thoroughly prior to installation. Utilize plugs to minimize entry of foreign materials into pipe.
- F. Torque wrenches required to tighten all mechanical joint fittings with applied torque conforming to pipe and fitting manufacturer's requirements.
- G. Piping shall be carefully lowered into the excavation. Suitable excavated material shall be placed to maintain equal depth on both sides of the pipe and to prevent movement of the pipe from its proper alignment.
- H. All damage resulting from inadequate bracing or shoring will be the responsibility of the Contractor, who shall make all necessary repairs at his/her own expense.
- I. The Contractor shall use extra caution to avoid disturbing any water service connections. Any disruption of water service shall be immediately reported to the Water Department and the property Owner.
- J. Property owners whose driveways will be blocked shall be notified 24 hours in advance of the excavation. Driveways shall not be blocked at night without the expressed consent of the property owner.

- K. Pipe shall be laid directly on the trench bottom. Prior to lowering pipe into 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.
- L. No pipe shall be laid, in wet trench conditions, on frozen trench bottom, or when Owner determines weather conditions are unsuitable for proper installation.

3.02 EXISTING WATER MAIN CONNECTION

- A. Tap water main location indicated in coordination with requirements of Water Department.
- B. Install tapping sleeve and tapping valve in accordance with manufacturer's instructions. Position flanged outlet for wedge valve.
- C. Coordinate connection of all services with Owner.

3.03 INSTALLATION OF FUSION WELDED PE PIPE

- A. Joints between plain ends of polyethylene pipe shall be made by butt fusion when possible.
- B. Pipe Manufacturer's fusion procedures shall be followed at all times as well as the recommendations of the Fusion Machine Manufacturer.
- C. Wall thicknesses of the adjoining pipes shall have the same DR at the point of fusion.
- D. When saddle connections are fusion welded, the Manufacturer's recommended saddle fusion procedures shall be used.
- E. If mechanical fittings are utilized for transitions between pipe materials, repairs, joining pipe sections, saddle connections, or at other locations, the recommendation of the Mechanical Fitting Manufacturer must be followed. These procedures may differ from other pipe materials.
- F. On each day butt fusions are to be made, the first fusion of the day shall be a trial fusion. The trial fusion shall be allowed to cool completely, then fusion test straps shall be cut out.
- G. The test strap shall be 12" or 30 times the wall thickness in length (minimum) and 1" or 1.5 times the wall thickness in width (minimum).

- H. Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new trial fusion shall be made, cooled completely, and tested. Butt fusion of pipe to be installed shall not commence until a trial fusion has passed the bent strap test.
- I. Socket and Saddle fusions shall be tested by a bent strap test as described by the Pipe Manufacturer. The pipe Manufacturer shall provide visual guidelines for inspecting the butt, saddle, and socket fusion joints.
- J. Pressure testing shall be conducted in accordance with the Manufacturer's recommended procedure and AWWA Standards. Pressure testing shall use water as the test media. Pneumatic testing is prohibited.

3.04 INSTALLATION OF SURFACE FUSION WELDED PIPE

- A. Lay pipes on ground surface in approximate location shown on Drawings.
- B. Provide gradual pipe bends with long radius curvature and no sharp bends or kinks in lines.
- C. Provide casings for pipes to cross under traveled areas and roadways where required by Town.

3.05 PLACEMENT OF WATER LINE THRUST BLOCKS

- A. Concrete shall be poured in place or precast:
 - 1. Poured in place thrust blocks shall be constructed by pouring concrete between the fitting and the undisturbed wall of the trench. Care shall be exercised to ensure that the concrete is placed clear of joint accessories, bolts, nuts, and flanges.
- B. Thrust blocks are required whenever the pipe:
 - 1. Changes direction at tees, bends, crosses, and tapping sleeves.
 - 2. Changes sizes as at reducers.
 - 3. Stops as at dead ends.

3.06 HYDRANTS

- A. Install fire hydrants in approved locations and to requirements of Town of Bar Harbor.
- B. Clean hydrants prior to installation.
- C. Support hydrant to maintain vertical position utilizing 24" x 24" concrete paver block.

3.07 FLUSHING AND DISINFECTION

- A. General: At completion of water distribution line installation but prior to connection to existing water supply, flush and disinfect in conformance with AWWA C651-05, the Maine Department of Health and Human Services, and Water Department requirements.
- B. Initial flushing shall be conducted to remove dirt, sediment and debris from the line. Ductile iron pipe shall be flushed at a rate of 2.5 FPS and PVC pipe shall be flushed at a rate of 3.0 FPS in accordance with AWWA C605-94.
- C. Disinfect the lines using one of two methods in accordance with AWWA C651-99:
 - 1. Slug method – Apply 100 mg/l slug dose of free chlorine throughout the entire line length for a minimum of three hours. Time begins when the 100 mg/l dose reaches the end of the line. Over a three hour period, the free chlorine level in the line may not fall below 50 mg/l.
 - 2. Continuous Feed Method – Apply a 1% chlorine bleach solution to the lines to provide a free chlorine level of at least 25 mg/l at the end of the line. After 24 hours, the residual at the end of the line must not be below 10 mg/l.
- D. During the disinfection process, flush all valves and hydrants to ensure adequate chlorine contact.
- E. The disinfection test fails and must be repeated if any of the above residual target levels are not met.

- F. Final flushing of the line must be completed within 24 hours after the required contact period to remove chlorine to a residual of 1 mg/l or less.
- G. Bacteriologic Test: Two samples for coliform testing must be conducted 24 hours apart from a location every 1200 LF along the pipe and also at the end of the new line. Sampling must begin no less than 16 hours after the completion of flushing.
- H. Bacteriological samples must be analyzed by a Maine Certified Laboratory.
- I. If bacteria tests fail, lines must be reflushed, disinfected, and resampled until the tests pass. All retest shall be paid for by the contractor.

3.08 TESTING

- A. Notify Owner at least 48 hours prior to testing.
- B. Hydrostatic testing of completed lines shall be at least 1.5 times the working pressure for 2 hours, but shall be no less than 200 psi.
- C. Leakage shall be less than the allowable quantities as defined in AWWA 1977 (600-77) Section 4 as shown below:

Allowable Leakage per 1000 ft of Pipeline – gph

Avg. Test pressure psi	Nominal Pipe Diameters – in.															
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450	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	0.45	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	0.42	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	0.39	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	0.37	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	0.36	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	0.34	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	0.32	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	0.30	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	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125	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	0.23	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

3.09 TEMPORARY WATER

- A. The contractor may, at their discretion, provide temporary water in order to facilitate construction of the new work.
- B. The cost of providing temporary water is incidental to the project.
- C. Products delivered under this specification shall be manufactured only from water distribution pipe and couplings conforming to ASTM 2241. Pipe, couplings, and locking splines shall be completely non-metallic to eliminate corrosion problems.
- D. Pipe and couplings shall be made from unplasticized PVC compounds having a minimum cell classification of 1254-B, as defined in ASTM D1784. The compound shall qualify for a Hydrostatic Design Basis (HDB) of 4000 psi for water at 73.4°F, in accordance with the requirements of ASTM D2837.
- E. Copies of agency approval reports or product listings shall be provided to the Owner. Products intended for contact with potable water shall be evaluated, tested, and certified for conformance with NSF 14 for PVC coupled components and NSF 61 for Integral Bell and glass fiber reinforced plastic components.
- F. Nominal outside diameters and wall thicknesses of thrust-restrained pipe shall conform to the requirements of ASTM 2241. Thrust-restrained pipe shall be furnished in 2” through 16” sizes, in Class 100 (SDR41) through (DR13.5). Pipe shall be furnished in standard lengths of 20 feet.
- G. Pipe shall be joined using non-metallic couplings or Integral Bells to form a restrained system with maximum reliability and interchangeability. High-strength, flexible thermoplastic splines shall be inserted into mating, precision-machined grooves in the pipe, coupling and bell to provide full 360° restraint with evenly distributed loading. Temporary waterline service connection shall be installed using IPS service saddles compatible with standard AWWA Copper service connections.
- H. Couplings shall be designed for use at or above the rated pressure of the pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F477. Joints shall be designed to meet the leakage test requirements of ASTM D3139.

- I. All flushing and disinfection requirements must be followed prior to placing temporary water on-line.

3.10 METER OR BACKFLOW PITS

- A. Primarily due to considerations for access, safety and gravity drainage, it is preferred that meters or backflow prevention devices not be installed in pits. Where pit installations are proposed, they shall follow the guidelines as provided in Appendix D.
- B. They must be watertight with watertight manholes or access doors extending a minimum of 6 inches above grade and located to allow natural light into the pit during testing/maintenance.

3.11 INSTALLATION OF STRUCTURES

- A. Place bases on compacted bedding material so precast structure is plumb and pipe inverts are at proper elevations.
- B. Place riser and top sections in the appropriate height combinations.
- C. Plug all lifting holes inside and out with non-shrink grout.
- D. Follow manufacturer's instructions for sealing joints between precast sections. Provide two rings of 1-inch diameter butyl rubber sealant.
- E. Point joints inside and out with butyl caulk.
- F. Set frames and covers to 1/2" below final pavement grade in paved areas. Set 2" below finish grade in unpaved roads or set at 6" above grade in cross country areas or lawns.
- G. Provide adequate temporary covers to prevent accidental entry until final placement of frame and cover is made.
- H. Use two rings of 1-inch diameter butyl rubber sealant between frame and riser rings.
- I. Provide downward force to frame so as to compress the joint and provide a watertight seal and prevent future settlement.

- J. Point compressed joint with butyl rubber caulk sealant.
- K. Set frames and covers to final grade only after pavement base course has been applied, or after final grading of gravel roads.
- L. Install seals at each joint if specified.
- M. Install cover seal if specified.

3.12 ABOVE GRADE ENCLOSURES

- A. Provide prefabricated above grade enclosures that provide heat, gravity drainage and removable access panels for servicing and testing. As an alternate, wood frame, fiberglass, steel, masonry or precast concrete structures may be utilized. All enclosures shall be designed:
 - 1. With a floor elevation that is at least 6 inches above finished grade.

3.13 BACKFLOW TESTING

- A. The backflow assembly must be tested upon installation by a certified tester. Results must be submitted to the Water Department along with any applicable record drawings.
- B. The assembly must be tested annually with results submitted to the Water Department.

END OF SECTION

SECTION 4

HOT BITUMINOUS PAVING

SECTION 4 - HOT BITUMINOUS PAVING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide bituminous paving as necessary to restore areas disturbed by work. This Section includes the following:
1. Paving of all new roadways, driveways, and sidewalks.
 2. Paving of all existing pavement areas disturbed by the work.
 3. Replacement of all disturbed pavement markings and painting new markings.
 4. Temporary and permanent trench paving.
 5. Repayment of any other existing paved areas damaged by Contractor's operations.
 6. Bituminous tack coat.

1.02 RELATED SECTIONS

- A. Section 2 - Earthwork (includes base, subbase, compaction).

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot mix asphalt similar to that indicated for this project and with a record of success in service performance.
- B. Standards: Current version of 'Standard Specifications Highways and Bridges', Maine Department of Transportation, and 'Special Provision, Hot Mix Asphalt Pavement' by MDOT and subsequent revisions.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement marking materials to project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacturers, and directions for storage.
- B. Store pavement marking materials in a clean, dry, protected location and within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if the following conditions cannot be met in the opinion of the Owner:
 - 1. Prime and Tack Coats: Minimum air temperature of 50°F (10°C) and rising in the shade at job site and gravel base not excessively damp or wet and binder layer dry.
 - 2. Asphalt Base Course: Minimum air temperature of 35°F (2°C) and rising in the shade at time of placement and area to be paved is not frozen nor excessively damp or wet.
 - 3. Asphalt Surface Course: Minimum air temperature of 50°F (10°C) and rising (10°C) in the shade at time of placement, and asphalt base course dry.
- B. Pavement Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40°F (4°C) for oil based materials, 50°F (10°C) for water based materials, and not exceeding 95°F (35°C) and after pavement has cured for minimum of thirty days.
- C. Surface Preparation: The surface upon which bituminous mixture is to be placed shall be thoroughly cleaned of all loose materials if pavement and compacted to a smooth regular surface if gravel aggregate base. When the surface of areas to be paved is irregular, it shall be brought to uniform grade and cross section with shim or gravel as directed. All driveway areas and trench repairs shall be prepared with base materials matching existing materials and compacted to provide a suitable paving surface.
- D. No permanent paving in shall be undertaken without prior authorization of Owner.

PART 2 - PRODUCTS

2.01 HOT BITUMINOUS PAVEMENT MIXES

A. Provide materials meeting MDOT Specification 401 and 403 as follows:

1. Binder (Base) Course: MDOT Type 19 mm.
2. Surface Course: MDOT Type 12.5 mm.
3. Driveway Pavement or Overlays: MDOT Type 9.5 mm.
4. Sidewalks: MDOT Type 9.5 mm in two layers.
5. Shim: MDOT Type 9.5 mm.

B. Aggregates for hot mix pavement shall conform with MDOT Special Provisions as follows:

Grading

Percent By Weight Passing - Combined Aggregate

<u>Sieve Size</u>	<u>Type 19 mm</u>	<u>Type 12.5 mm</u>	<u>Type 9.5 mm</u>
37.5 mm (1 1/2")			
25 mm (1")	100		
19 mm (3/4")	90-100	100	
12.5 mm (1/2")	-90	90-100	100
9.5 mm (3/8")	-	-90	90-100
4.75 mm (No. 4)	-	-	-90
2.36 mm (No. 8)	23-49	28-58	32-67
1.18 mm (No. 16)	-	-	-
0.60 mm (No. 30)	-	-	-
0.30 mm (No. 50)	-	-	-
0.075 mm (No. 200)	2-8	2-10	2-10

2.02 BITUMINOUS TACK COAT

A. Emulsified asphalt, conforming to AASHTO M140, as modified per MDOT 'Standard Specification, Section 702.04.

2.03 PAVEMENT MARKINGS

- A. Pavement Marking Paint: Pavement marking paint for final and temporary pavement marking shall meet the requirements of the Maine DOT Maintenance Fast-Dry Water-Based Traffic Paint (Federal Specification TT-P-1952D for waterborne paint and air field markings). Glass beads shall conform to the requirements of AASHTO M 247, Type 1.

2.04 TEMPORARY PAVEMENT

- A. Emulsion Cold Patch with ½ inch maximum stone size and MC 250 Emulsion acceptable to Owner and MDOT.

2.05 RECYCLED PAVEMENT

- A. Recycled material, shall consist of material from the project or from off-site stockpiles that has been processed before use to 100% passing a 2 inch square mesh sieve. It shall be free of winter sand, granular fill, construction debris, and other materials not generally considered bituminous pavement.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install according to MDOT 'Standard Specification' Sections 401, 403, and other applicable sections.

3.02 HOT BITUMINOUS PAVEMENT

- A. Conditioning of Existing Surface:
 1. The surface upon which bituminous mixture is to be placed shall be thoroughly cleaned of all debris and objectionable material as determined by Owner. When the surface of the existing base or pavement is irregular or specified grade, it shall be brought to uniform grade and cross section as directed or as specified.
 2. Base course shall be shaped to a tolerance above or below the required cross sectional shape of 3/8 inch.
 3. Do not place pavement if base or existing pavement layers are wet, excessively damp, or frozen.

4. Place binder and surface courses to the depth and elevations shown on the Drawings.

B. Weather and Seasonal Limitations:

1. For seasonal limitations, the State is divided into 2 paving zones:

Bar Harbor is located in MDOT Paving Zone 2.

- a. Zone 2. All area south of Zone 1 including the US Route 2 and Route 9 boundaries.

Bar Harbor is located in MDOT Paving Zone 2.

2. Seasonal Limitations: Bituminous plant mix for use other than traveled way wearing course may be placed between the dates of April 15th and November 15th, provided that the air temperature as determined by an approved thermometer placed in the shade at the paving location is 2°C (35°F) or higher and the area to be paved is not frozen. Plant mix to be placed as traveled way wearing course may be placed in Zone 2 between the dates of April 15th and the Saturday following October 15th provided the air temperature determined as above is 10°C (50°F) or higher. The traveled way as used herein shall also include truck lanes, ramps, approach roads, and auxiliary lanes.
3. Any hot bituminous base or binder course that is to be subjected to traffic during the winter months shall have its gradation densified or asphalt content (percent of mix) adjusted at no cost to the Owner through a change in the job mix formula as submitted by the Contractor and approved by the Engineer.
4. Hot bituminous mixtures used for curb, driveways, sidewalks, island, or other incidentals are not subject to seasonal limitations, except that weather conditions shall be satisfactory for proper handling and finishing of the mixture. Bituminous plant mix shall not be placed on a wet surface or a frozen surface. The ambient air temperature in the shade shall be 2°C (35°F) or higher and rising.
5. The Owner may authorize construction of bituminous pavements at lower atmospheric temperatures than those specified or extend the dates of the

paving season. However, the Contractor shall remain responsible for meeting all pavement quality, performance requirements, and warranty.

- C. Trucks used for hauling bituminous mixtures shall meet the requirements of MDOT 'Special Provision' Section 401.09.
- D. Pavers shall meet the requirements of MDOT 'Special Provision' Section 401.10.
- E. Rollers shall meet the requirements of MDOT 'Special Provision' Section 401.11.
- F. Spreading and Finishing:
 - 1. The mixture shall be laid upon an approved surface, spread and struck off to the grade and elevation established.
 - 2. Bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable.
 - 3. During placing operations, sufficient bituminous mixture shall be delivered to the project to maintain a constant paving speed. The paver speed shall be adjusted to the plant production capabilities regardless of haul distance.
 - 4. The moving reference shall consist of a manufacturer approved ski-type attachment or traveling string line, not less than 30 feet (9 m) in length, attached to the paver and operating parallel to its line of travel. A shoe or joint matcher, may be permitted to construct the joint on the last course of surface mixture.
 - 5. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture shall be spread, raked, and luted with hand tools. For such areas the mixture shall be dumped, spread, and screeded to give the required compacted thickness.
 - 6. On roads opened to two way traffic, the placement of each course shall be completed over the full width of the traveled way section being paved on each day's run unless otherwise approved.
- G. Compaction: Immediately after the bituminous mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly and uniformly

compacted by rolling. Minimum compaction shall be 92% to 97% of theoretical maximum density (TMD) using ASTM D 2071, and in accordance with MDOT Section 401.

1. The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, or shoving. To prevent adhesion of the mixture to the rollers or vibrating compactors, the rolls of contact surfaces shall be kept moistened with water or water mixed with small quantities of detergent, or other approved method. Oil will not be permitted.
2. Unless otherwise directed, rolling shall begin at the low side and proceed longitudinally parallel to the centerline, each trip overlapping the previously rolled strips, gradually progressing to the high side using a uniform rolling pattern that will insure complete coverage of the entire mat.
3. When abutting a previously placed lane, the longitudinal joint should be rolled first followed by the regular rolling procedure.
4. Rollers shall move at a slow uniform speed with the drive roll wheels nearest the paver. Rolling shall be continued until all roller markings are eliminated.
5. Any displacement occurring as a result of the reversing of the direction of a roller or from other causes, shall be corrected at once by the use of rakes or lutes and additional fresh mixture when required. Care shall be exercised in rolling not to displace the line and grade of the edges of the bituminous mixture.
6. Along forms, curbs, headers, walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with mechanical vibrating compactors. Hand tamping will be permitted only for areas inaccessible to other compaction equipment.
7. Mixture that becomes loose and broken, mixed with dirt or is in any way defective shall be removed and replaced with fresh, hot mixture, which shall be compacted to conform with the surrounding area.
8. Mixture showing an excess or deficiency of bituminous material shall be removed and replaced.

- H. Joints: Wearing course transverse joints shall be constructed using shims equal to the depth allowed for compaction.
1. The paver shall always maintain a uniform head of material during the joint construction.
 2. The bituminous mix shall be free of segregation and meet temperature requirements.
 3. Transverse joints of the wearing course shall be straight and neatly trimmed. A vertical face exposing the full depth of the course may be formed by inserting a header, by breaking the bond with the underlying course or by cutting back with hand tools.
 4. Edges of joints that are to form longitudinal joints shall be maintained vertically.
 5. A coating of emulsified asphalt shall be applied each day prior to paving. The application shall be by an approved spray apparatus designed for covering a narrow surface. Application of this material by a brush may be approved for small surfaces or in the event of a malfunction of the spray apparatus, but for a period of not more than one working day.
 6. When new pavement joins an existing pavement, and when directed, the existing pavement shall be cut along a smooth line and to a neat, even vertical joint. Broken or raveled edges will not be permitted. All work necessary for the preparation of this joint will be considered as incidental to the related contract items.
- I. Surfaces Tolerances: The surface shall be tested by the Owner with a 16 foot (4.9 m) straightedge or string line placed parallel to the centerline of pavement and with a 10 foot (3 m) straightedge or string line placed transversely to the centerline of pavement. Variations exceeding 1/4 inch (6 mm) shall be corrected by removing defective work and replacing with new material as directed. A 10 foot (3 m) straightedge, shall be furnished by the paving contractor if requested by the Engineer.

3.03 BITUMINOUS TACK COAT

- A. Install according to MDOT 'Standard Specification' Section 409.

- B. Apply uniformly to existing surfaces of previously constructed bituminous paving and to surfaces abutting or projecting into new, hot bituminous pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Tack coat not required when surface course is to be applied immediately after binder is applied.

3.04 PAVEMENT MARKING

A. General:

- 1. No markings shall be applied for a minimum of thirty days after paving or unless otherwise directed by Owner.
 - 2. All pavement lines and markings shall be applied in accordance with the Manual on Uniform Traffic Control Devices.
 - 3. Longitudinal lines placed on tangent roadway segments shall be straight and true. Longitudinal lines placed on curves shall be continuous smoothly curved lines consistent with the roadway alignment. All pavement markings placed shall meet the dimensions and layout shown on the plans or as existed in the field prior to the start of work.
 - 4. Broken lines shall consist of alternate 3 m (10 foot) painted line segments and 9 m (30 foot) gaps.
 - 5. Temporary pavement markings shall be applied in accordance with the pattern shown on the plans or as directed.
 - 6. Newly painted lines, markings, and curb shall be protected from traffic by the use of cones, stationary vehicles or other approved methods until the paint is dry.
- B. Preparation of Surface: Immediately before applying the pavement marking paint to the pavement or curb, the surface shall be dry and entirely free from dirt, grease, oil or other foreign matter.

C. Application:

1. Prior to applying paint for final pavement lines, the Contractor shall perform a test for paint thickness by furnishing and placing a piece of smooth, clean metal with an area of at least 144 square inches (0.1 m²) in the path of the striping truck. The striping truck shall be passed over the piece of metal, painting the surface as it passes, without applying beads. The result of this test will be used to determine the pressure setting and speed of the truck when applying paint to obtain the specified thickness. Additional paint thickness testing may be required on the final paint markings. The wet thickness of paint without beads on final pavement lines shall be a minimum of 16 mils (0.400 mm).
2. On other final pavement markings and on curb, where the paint is applied by hand painting or spraying, application shall be in two uniform covering coats, each at least 10 mils (0.25 mm) thick. Before the second coat of paint has dried, the glass beads shall be applied by a pressure system which will force the glass beads onto the undried paint as uniformly as possible.
3. Glass beads shall be applied to the final and temporary pavement lines, marking and curb at the rate of 4.5 pounds per gallon (0.54 kg/L) of paint and in sufficient quantity to assure complete and uniform coverage of hand painted surfaces.

D. Establishment Period:

1. Marking material furnished and installed under this contract for final pavement markings shall still be subject to a six month period of establishment.
2. The period of establishment shall commence as soon as the markings are complete and in place and shall continue for six months. At the end of the establishment period, a minimum of 95 percent of the markings shall still be in place to be acceptable.
3. If less than 95 percent of the markings are in place after six months, the Contractor shall replace all unsatisfactory markings on the project without additional payment.
4. Markings designated for replacement shall be installed according to these specifications, unless otherwise directed.

5. Markings replaced at the end of the six month establishment period will not be subject to a further establishment period.
- E. Removing Lines and Markings: When it is necessary to remove pavement lines and markings, it shall be done by grinding, high temperature flame, sand blasting, solvent or other acceptable means. The method chosen must be capable of completely eradicating the existing line or marking without damage to the pavement. Burning and grinding to remove temporary markings from final pavement or from existing pavement not to be resurfaced shall not be permitted.

END OF SECTION

SECTION 5

LAWNS AND GRASSES

SECTION 5 - LAWNS AND GRASSES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide landscape development work as shown on drawings, or as needed to restore disturbed areas, including:

Repairing disturbed grassed areas.
Planting new grass on project areas
Mulching of all revegetated areas

- B. Repair all grassed areas disturbed during performance of the Work. Where existing topsoil remains, provide seed, lime and fertilizer to re-establish lawn. Provide additional topsoil where necessary. Sodding may be substituted at the Contractor's discretion.

- C. Earthwork: See Section 2.

1.02 DELIVERY, STORAGE AND HANDLING

- A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- B. Sod: Time delivery so that sod will be placed within 24 hours after stripping. Protect sod against drying and breaking of rolled strips.

1.03 JOB CONDITIONS

- A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required. When conditions detrimental to plant growth are encountered, notify Owner before planting.

PART 2 - PRODUCTS

2.01 TOPSOIL

- A. Provide topsoil as required to complete repair of lawn areas.
- B. Provide topsoil which is fertile, friable, natural loam surface soil found at a depth of not less than 4" from the original ground surface, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than ½" in any dimension, and debris.
- C. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at project site. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4"; do not obtain from bogs or marshes.

2.02 SOIL AMENDMENTS

- A. Lime: Natural limestone containing not less than 90% total carbonates, ground so that not less than 90% passes a 10-mesh sieve and not less than 50% passes a 100-mesh sieve.
- B. Fertilizer: 10-10-10 grade commercial type with 50% of the elements derived from organic sources.

2.03 GRASS MATERIALS

- A. Sod:
 - 1. Provide strongly rooted sod, not less than 2 years old, free of weeds and undesirable native grasses and machine cut to pad thickness of ¾" (+/- ¼"), excluding top growth and thatch.
 - 2. Provide only sod capable of vigorous growth and development when planted (viable, not dormant).
 - 3. Provide sod of uniform pad sizes with maximum 5% deviation in either length or width. Broken pads or pads with uneven ends will not be acceptable.

4. Sod pads incapable of supporting their own weight when suspended vertically with a firm grasp on upper 10% of pad will be rejected.

B. Grass Seed: Provide fresh, clean, new-crop seed.

Germination: Not less than 80%

Purity: Not less than 85%

Weed content: Not more than 1%

Do not use seed which has become wet, moldy or damaged.

C. Seed Mixture: 40% Creeping Red Fescue, 30% Kentucky Bluegrass, 20% Perennial Rye grass, 10% White Clover.

2.04 MULCH

A. Straw mulch shall consist of long fibered straw, free from noxious weeds, seeds, and other undesirable material.

1. No material which is wet, decayed, or compacted shall be used.

2. No chopped hay, grass clippings, or other short fibered material shall be used unless directed.

PART 3 - EXECUTION

3.01 RESTORATION SEQUENCING

A. Restore all vegetated surfaces immediately upon completion of construction work with reasonable delays for weather conditions excluded.

B. Follow erosion control requirements defined in Contract Documents during all periods up to full establishment of vegetation as accepted by Owner.

C. No more than 500 LF of trench may remain unvegetated at any time. Owner may require Contractor to suspend all other work to complete surface restoration should the 500 LF limit be exceeded. Such suspension shall not be cause for claim of damages by Contractor.

D. No more than 3000 SF of disturbed surface area may remain unvegetated at any time. Owner may require Contractor to suspend all other work to complete surface restoration should the 3000 SF limit be exceeded. Such suspension shall not be cause for claim of damages by Contractor.

- E. Owner views prompt surface restoration as very high priority and Contractor shall make every effort to comply with this requirement including adding additional project personnel as required to perform site restoration work.

3.02 PREPARATION

- A. Protect existing underground improvements from damage.
- B. Remove foreign materials, plants, roots, stones, and debris, from site. Do not bury foreign material.
- C. Mix soil amendments and fertilizers with topsoil. Mix lime with dry soil prior to mixing of fertilizer. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days.
- D. Spread top soil to minimum depth of 4 inches (or to depth indicated on Drawings) after light rolling and natural settlement. Add specified soil amendments and mix thoroughly into upper 2" of topsoil.
- E. Dispose of subsoil removed from landscape excavations. Do not mix with planting soil or use as backfill.

3.03 PLANTING

- A. Apply grass seed with hydroseed at rate of 5 lbs/1000 SF.
- B. Mulch all areas with straw.
- C. Repair areas damaged by Contractor's operations as directed by the Owner.
- D. Water newly planted areas and keep moist until new grass is established.

3.04 MULCHING

- A. Straw mulch for both seeded and unseeded areas shall be spread evenly and uniformly over the designated areas.
- B. Unless otherwise directed, mulch shall be applied at the rate of 1.5 to 2 tons per acre. Too heavy an application of mulch shall be avoided. Lumps and thick mulch material shall be thinned.

- C. Temporary mulching shall be spread immediately to protect wetlands and surface waters from erosion during all stages of construction throughout all seasons of the year.

3.05 MAINTENANCE

- A. Begin maintenance immediately after planting.
- B. Maintain until final acceptance but in no case less than 60 days after substantial completion of planting.
- C. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.

3.06 CLEANUP AND PROTECTION

- A. Restore pavement, grassed areas and planted areas damaged during execution of work of this Section.

3.07 INSPECTION AND ACCEPTANCE

- A. General: Landscape work may be inspected for acceptance in parts agreeable to Owner, provided work offered for inspection is complete, including maintenance.
- B. Replace rejected work and continue specified maintenance until reinspected by Owner and found to be acceptable. Remove rejected plants and materials promptly from project site.

3.08 EROSION REPAIRS

- A. Repair all erosion that occurs in vegetated area and sideslopes as the result of the grass root structure not being fully established and all erosion that occurs during the warranty period. Such repairs shall be at no cost to Owner.

END OF SECTION

SECTION 6

CAST-IN-PLACE CONCRETE

SECTION 6 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide all cast-in-place concrete work, including:

Concrete thrust blocks at all pressure pipe bends

PART 2 - PRODUCTS

2.01 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes by either laboratory trial batch or field experience methods as specified in ACI 301.

1. If trial batch method used, use an independent testing facility acceptable to Owner for preparing and reporting proposed mix design.
2. Test data provided shall be no more than one year old and shall be conducted on materials to be incorporated into work.

- B. Design mixes to provide normal weight concrete with the following properties.

1. General Use Concrete:

- Type II Portland Cement.
- Min. 28 day compressive strength: 4000 psi.
- Max. water/cement ratio: 0.45.
- Min. cement content: 564 lbs per cubic yard.
- Slump: Concrete for general use: not less than 1", not more than 4".
- Sloping surfaces: slump not more than 3".
- Concrete with high range water reducer (HRWR) admixture: not more than 8".
- Max. aggregate size: 3/4".
- Air Content: 6% +/- 1% by volume for 3/4" aggregate.
- Flyash shall be Class F and shall not exceed 10% cement content, meeting ASTM C618.

- D. Adjustment of Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; as accepted by Owner. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Owner before using in work.
- E. Concrete for cast-in-place thrust block shall have a minimum 28 day compressive strength of 2000 psi.

2.02 CONCRETE MIXING

A. Job-Site Mixing:

1. Mix materials for concrete in appropriate drum type batch machine mixer.
2. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
3. For mixers of capacity larger than one cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yds., or fraction thereof.

B. Maximum Delivery Time:

1. 1 1/2 hours below 85°F, or
2. When air temperature is between 85° F and 90° F, reduce mixing and delivery time from 1 1/2 hours to 75 minutes, or
3. When air temperature is above 90° F, reduce mixing and delivery time to 60 minutes.
4. Calculation of delivery time shall start at the point that water is first added to the mix.

PART 3 – EXECUTION

3.01 PLACEMENT OF PRESSURE PIPE THRUST BLOCKS

- A. Concrete shall be poured in place or precast.
 - 1. Poured in place thrust blocks shall be constructed by pouring concrete between the fitting and the undisturbed wall of the trench. Care shall be exercised to ensure that the concrete is clear of joint accessories, bolts, nuts, and flanges.

- B. Thrust blocks are required wherever the pipe:
 - 1. Changes direction at tees, bends, crosses, and tapping sleeves.
 - 2. Changes sizes, as at reducers.
 - 3. Stops, as at dead ends.

END OF SECTION

SECTION 7

INSULATION

SECTION 7 - INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Install insulation as directed by Owner and indicated by provisions of this section. Insulation specified in this section includes the following:

Rigid foam insulation for pipe trenches

1.02 QUALITY ASSURANCE

- A. Thermal Conductivity: Thicknesses indicated for board insulation are for thermal conductivity (k-value at 75°F or 24°C) specified for each material. Provide adjusted thicknesses as directed for equivalent use of material having different thermal conductivity.

1.03 PRODUCT HANDLING

- A. General Protection: Protect insulations from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

PART 2 - PRODUCTS

2.01 INSULATION

- A. Rigid Board-Type Insulation for Trenches and Pipe Insulation: Closed-cell rigid foamed polystyrene, equal to "Styrofoam" HI-60, by Dow Chemical, or Owens Corning Foamular 600. Thickness as shown.

1. Thermal resistance: Aged R-value = 5 per inch of 75°F mean temperature.
2. Compressive strength ≥ 60 psi.
3. Flexural strength ≥ 75 psi.
4. Minimum density 1.60 PCF.

5. Water adsorption ≤ 0.1 percent by volume.
6. Coefficient of linear thermal expansion: maximum 3.5×10^{-5} in/ °F.
7. Complies with ASTM C578 Type VII.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor and moisture barriers, including removal of projections which might cause punctures.
- B. Any mains or services installed with less than 5' of cover shall be covered with one layer of 2" thick insulation. If conditions exist where there is less than 4' of cover, provide a double layer of insulation.

3.02 INSTALLATION OF RIGID BOARD INSULATION

A. General:

1. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's mechanical representative for specific recommendations before proceeding with work.
2. Extend board insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.
3. Apply a single layer of board insulation of required thickness, unless otherwise shown or required to make up total thickness.
4. For pipe trench insulation, provide to the extent practical, full sheets of insulation over trench width to minimize the number of openings between sheets. Add 2' long piece of insulation over each joint. Use four foot minimum width sheets centered on pipe(s), and add additional width to fill trench as necessary, or as directed by Owner.

5. Over or adjacent to precast concrete structures, provide 4' wide sheets over structure and extend outside structural wall a minimum of 2' for full perimeter.

3.03 PROTECTION

- A. General: Protect installed insulation and vapor barriers from harmful weather exposures and from possible physical abuses, where possible by not delaying installation of concealing work or, where that is not possible, by temporary covering or enclosure. Installer shall advise Contractor of exposure hazards, including possible sources of deterioration and fire hazards.

END OF SECTION