

**Specifications and Details
for the
Installation of Water Lines
and
Appurtenances**



Norwich Public Utilities
16 South Golden Street
Norwich, CT 06360

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SECTION 1.0 - GENERAL

1.01 DESIGN REFERENCES

State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, latest edition as amended.

American Water Works Association (AWWA) Manuals and Standards of Practice

American National Standards Institute (ANSI)

American Society for Testing and Materials (ASTM)

State of Connecticut Public Health Code

State of Connecticut Plumbing Code

State of Connecticut Guidelines for Soil Erosion and Sediment Control

FHWA Manual on Uniform Traffic Control Devices (MUTCD)

All references to AWWA, ANSI, ASTM, State, or other codes shall be to the most recent edition available, at the time of construction.

1.02 INTENT

These specifications shall consist of policies, guidelines, and required procedural steps related to the excavation, installation, backfill, and testing required for water line construction for Norwich Public Utilities (NPU) They also include detailed material specifications and typical details that are necessary for a complete water distribution/transmission system.

All water pipes, fittings, valves and boxes, corporations and curb stops, curb boxes, and service tubing installed on NPU's side of the curb stop will become the property of NPU. Equipment must be approved by NPU prior to installation.

Any deviations from these specifications shall be approved by NPU prior to construction.

1.03 SUBMITTALS FOR REVIEW

- A. All products, including "approved equal" alternatives, shall be reviewed and approved by NPU. The submittal of any item shall include sufficient information for a determination of acceptability. At a minimum, the information will include a description of the item, detailed materials information or reference to universally recognized standards (AWWA, ANSI, ASTM, etc.), a description of the methods to be used for construction and/or installation and any testing necessary to verify the quality of the product or installation of product. NPU may also require a list of locations and contact information where the item has previously been installed or the procedure used. It is not the intent of this document to prevent alternative solutions; however, the burden of proof for acceptance of alternate solutions lies with the Contractor proposing the substitution.

B. Engineering Plans and Design

- I. Prior to submitting any plans for development, a Developers Agreement must be submitted to NPU. It is strongly recommended that a pre-development meeting be scheduled with appropriate NPU staff.
- II. One complete set of construction drawings and specifications for the proposed water system project shall be prepared and submitted stamped by a licensed Professional Engineer registered in the State of Connecticut for review and approval.
- III. Drawings shall be submitted electronically in PDF. They shall be formatted on ARCH D (24" x 36") paper size and drawn to scale. Drawings shall contain a location map, plan and profile, types of materials to be used, locations of existing and proposed utilities, and any necessary water system components required for the complete installation of the project. Typical details, materials and installation specifications shall be provided with all drawings.
- IV. The plans must be reviewed to determine compliance with all water specifications at critical stages throughout the project as determined at the pre-construction meeting or after discussions with NPU staff. The level of engineering detail required for approval generally increases with each stage of project approval. All construction drawings and specifications shall have a note stating, "All work to be performed in accordance with NPU Specifications and Details for the Installation of Water Lines and Appurtenances, latest edition." Upon receiving acceptable final engineering plans, NPU will approve the plans for construction.
- V. Any project involving tapping the water main shall have drawings submitted to NPU for review.
- VI. No water main extensions or alterations will be constructed without the written approval of NPU. All contract documents shall meet all aspects of these Specifications.
- VII. The project shall be constructed, completed, maintained, and operated in accordance with the approved plans. No changes shall be made without the written approval of NPU.
- VIII. All water mains, appurtenances and other materials, and construction methods shall conform to the most recent edition of all applicable AWWA, ANSI, ASTM, State and Local codes, standards and regulations. In the case of conflict between these specifications and a code or regulation stated above, it shall be resolved to the satisfaction of NPU prior to approval.
- IX. The Applicant, Developer, Contractor or Owner of record shall procure all permits, licenses, and easements that may be required to complete planned construction, including payment of all applicable fees, and shall comply with all conditions set forth in each permit.
- X. As-built drawings will be submitted at the completion of the work as described in these specifications.

C. Certificates

Any certifications that field tests have been performed and that work meets or exceeds specified requirements must be submitted prior to project completion.

1.04 PERMITS

- A. No person(s) shall uncover, make any connection with, alter, repair, or disturb any public water system component connected to NPU pipe, or appurtenances unless a valid permit or approval has been issued by NPU.
- B. Owner/Developers must first apply to NPU using the Permit to Connect application located in Appendix A.
- C. Permits shall only be issued to a licensed Contractor holding a valid State of Connecticut license to perform the unsupervised installation of water mains, services, and appurtenances. The acceptable contractor license categories shall be P-1 and P-7 Plumbing Licenses only.
- D. For the extension of public water mains, no permit shall be issued, nor any connection made until a Developers Agreement has been approved by NPU.
- E. Prior to issuing any construction permit, the Developer/Contractor will be required to pay all outstanding fees, charges, assessments, and other conditions applicable to the water installation. If working outside the confines of private property, the Contractor shall obtain any excavation permits necessary from the City or State.
- F. For water extensions, licensed Contractors shall also be required to post with NPU a Certificate of Insurance. Exact insurance requirements will be provided by NPU Purchasing Department.
- G. In all instances requiring that the permittee be a licensed Contractor, the Plumbing Contractor's License, Certificate of Insurance, and Surety Bond (if applicable) submitted to NPU shall be those of the Permittee only. The amount and necessity of Surety Bonds will be decided on a case-by-case basis at the discretion of NPU and agreed on by all parties in the Developers Agreement.
- H. Permits may be revoked and annulled by NPU for any violation of these Specifications, or suspended for a reasonable period, to allow NPU to make an investigation to determine if there has been a violation of the regulations.
- I. The issuance of a permit does not authorize the Contractor or Permittee to operate valves, curb stops, or other appurtenances connected to NPU system.
- J. The Contractor or Permittee is responsible for obtaining all State, City or Town road opening permits as required.

- K. The Contractor is responsible for obtaining the locations of all utilities and/or structures which he may encounter and is totally responsible for any damage caused to the utilities and/or other structures. The Contractor shall be responsible for control of water, barriers, fences, warning lights, and anything else required for the installation by any applicable Local, State, or Federal agency.

1.05 INSURANCE

The Contractor shall have insurance coverage required by applicable agencies. The Contractor shall indemnify and hold harmless NPU and the City of Norwich against any and all damages to property or injuries to or death of any person or persons, including property and employees or Agents of NPU or the City of Norwich, and shall defend, indemnify and save harmless NPU or the City of Norwich from any and all claims, demands, suits, actions or proceedings of any kind or nature including workmen's compensation claims, of or by whomsoever, in any way resulting from or arising out of the operations in connection herewith, including operations of Sub-Contractors and acts or omissions of employees or Agents of Contractor or his Sub-Contractors.

1.06 RESPONSIBILITY FOR LEAKS AND REPAIRS

The Customer is responsible for repairing all leaks and for all other repairs, renovations and maintenance to all Customer-owned pipes, fixtures and equipment. If a leak develops in a Customer Service Line or a Customer-owned Service Connection, the Customer shall repair it within 30 (thirty) days notification by NPU by telephone, in-person or in writing to the Customer. If such repair work is not completed within such a period, NPU will discontinue Service until the leak is repaired.

NPU retains the right to repair the leak(s) at the Customer's expense and will bill the Customer for all labor and material costs associated with any repairs.

1.07 EASEMENTS

In general, water mains and appurtenances shall be installed within public street lines. The easements shall be thirty (30) feet in width centered on the water main or cover the entire parcel of land. Extensions of public water mains requiring easements and/or agreements must have such easements and/or agreements approved, executed, and recorded on the Land Record prior to issuance of a permit for connection to the NPU water system. The easement deed shall contain language that specifically indemnifies and holds NPU harmless from any obligations, liabilities or claims arising from the existence of such easement or the construction of any utility within the easement, as well as wording preventing the construction of buildings or structures above the water line or within the water line easement.

1.08 INSPECTIONS

All materials and installations shall be approved and inspected by NPU before potable water is supplied.

During the installation of the mains and appurtenances, NPU may require either part- or full-time inspection (at their option) of the work, to see that these Specifications are followed. The cost of this inspection and other departmental costs incurred on the project such as review of drawings, purchase and handling of materials, etc. shall be paid by the Contractor.

No trench containing a water main, service pipe, or other appurtenance shall be backfilled until the NPU Inspector, or his duly authorized Agent has completed an inspection and found the work to conform to the requirements of NPU and these Specifications in all respects and to be satisfactory as to the quality of the workmanship and materials. The Contractor shall notify the NPU Inspector twenty-four hours before starting any work authorized under the permit. It shall be the responsibility of the Contractor to comply with any applicable safety requirements concerning the installation or repair of water mains, services, and/or appurtenances, and to provide the necessary safety equipment and conditions needed for inspection of such installations and/or repairs. The Inspector or his or her duly authorized Agent may order all or any portion of the work to be halted, revoke such permit for the work, and/or refuse inspection for noncompliance with the applicable construction and/or safety requirements.

If any person who constructs, installs, alters, or repairs any water main, service pipe or appurtenance within NPU's jurisdiction in violation of any section of these Specifications and/or any other Regulations of NPU or fails to give adequate notice to the inspector for an inspection of the work, the Inspector may order all or any portion of the work to be halted and/or uncovered for inspection and approval.

1.09 PRESSURE

Under normal conditions of use of water, NPU shall provide water pressure at a Customer's service connection of not less than 20 pounds per square inch (PSI) and not more than 120 PSI.

When NPU provides pressure as specified and the Customer desires a higher pressure, the Customer may install and maintain at their own expense a tank or booster pump as approved by NPU.

When NPU provides pressure as specified, and where the water pressure is greater than the Customer wishes, it is the Customer's responsibility to install the proper regulating device approved by NPU to reduce the pressure to the extent desired.

1.10 DESIGN

Average daily flow and peak flow for domestic, commercial, and industrial users/customers are to be based on Engineering Documentation. Water service lines shall be sized according to the latest AWWA M22 – Sizing Water Service Lines and Meters

The size of the water mains shall be subject to the approval of NPU and NPU may require a hydraulic analysis to ensure adequate flows and pressures are present. Projects which may have a significant or appreciable impact on the water system shall require the Applicant to provide NPU with a computerized hydraulic simulation model of the proposed modifications to the existing system. When, in the opinion of NPU, the proposed system modifications are of such magnitude that a full simulation of the entire system is deemed necessary, NPU will perform the necessary simulations at the Applicants expense. NPU will provide the Applicant with the cost to perform the simulation prior to the simulation being performed. Modelling will be required for all proposals meeting one or more of the following criteria:

- Residential development, ten (10) or more houses or condominium units.
- All industrial facilities or parks.

- All commercial facilities or parks.
- Application for service in an area of the system where pressure variations exceeds 50% of the average operating pressure.
- Application for service in an area of the system where elevation may impact the ability of the system to consistently provide the minimum pressure or volume requirements for service.
- At the discretion of NPU

1.11 EXPERIENCE

Contractors shall be actively engaged in the construction or installation of water mains and have in his employ mechanics and foremen who have experience in water main installation work and are fully conversant with the attendant hazards and safety procedures in this specialized field, and they shall also have experience in distribution and transmission systems for water pressure up to 150 psi.

1.12 CONNECTION TO EXISTING SYSTEM

The Contractor will install all parts of the work required except the actual connection or connections to the existing NPU system. These connections shall be made by NPU or their approved Contractor. The total cost of the connection shall be paid by the Contractor. Any existing water mains or appurtenances damaged by the Contractor will be repaired and the cost of the repairs will be paid by the Contractor.

1.13 WORK IN COLD WEATHER

NPU will determine when conditions are unfavorable for work and may order the work or any portion of it suspended whenever, in their opinion, the conditions are not such as will ensure first class work. All work shall be protected from freezing.

1.14 AS-BUILT DRAWINGS

Upon completion of all water main infrastructure and appurtenance work, the Contractor shall provide as-built drawings documenting the record of actual construction. The as-built drawings shall be on 24" x 36" sheets, plan scale 1" = 40' for review.

The Contractor shall provide as-built drawing reflecting accurate measurements from the building foundations and above grade permanent structures and or visible accessible permanent features to water appurtenances such as bends, valve boxes, services, etc. Valve boxes, curb boxes and telephone poles are not considered permanent features. The drawings set shall accurately mark the location of each infrastructure component or appurtenance as constructed including, but not limited to:

- Measured horizontal and vertical locations of the above and below grade water main, valves, fittings, services, and appurtenances, referenced to permanent surface improvements, above grade permanent structures, and/or permanent visible and accessible features of the installation.
- Information concurrent with the actual construction.
- Distance from the main to curb box at each service.

- Three point measured swing ties from permanent surface improvements, above grade permanent structures and/or visible and accessible features of the installation to identify all bends, services and end caps.
- Depth of main at maximum of 50-foot intervals. Ties at every 100-foot interval, each recorded service and at each bend.
- Total overall footage.
- Detail of water main tap connection and all utility crossings.
- The completed water main and its proper orientation.
- Valve opening rotation (open left or open right)

All as-built drawings shall be prepared under the direction of a registered Professional Engineer or Licensed Land Surveyor licensed in the State of Connecticut and so stamped and signed. As-built drawings shall not be accepted with disclaimers in reference to verification of measurements. As-built drawings shall consist of a cover sheet, standard details modified to as-built conditions, and all plan sheets.

Upon approval by NPU of the draft as-built drawings submission, the Contractor shall provide the final as-built drawings in a digital format acceptable to NPU.

1.15 GENERAL GUARANTEE

The Contractor shall guarantee his work for a period of one (1) year after the date of NPU's final inspection and acceptance as evidenced by a receipt of certificate of final acceptance. The guarantee shall cover all new and existing infrastructure that was constructed, repaired, or replaced as part of the project. The Contractor shall be responsible for any repairs or corrections as part of the project and shall, during the guarantee period, repair promptly at his own cost and expense, all breaks, failures, or defects which develop in the work because of faulty material of workmanship. Repairs made during the guarantee period will carry a guarantee of one year from the time that the repair was completed.

At the end of the guarantee period, an inspection will be performed by NPU, prior to NPU assuming ownership of any of the lines or appurtenances.

Final acceptance shall not take place until after the guarantee period is complete and NPU has determined that complete record information has been provided and all required improvements have been satisfactorily completed.

1.16 LIENS

The final acceptance of the work by NPU will not be made until NPU is satisfied that no liens have or can be placed for materials or labor on the water mains or appurtenances. If required by NPU, waivers of liens may be required.

1.17 RELATION TO SEWER MAINS

A. Horizontal Separation

Whenever possible, water lines shall be laid at a minimum at least 10 feet, horizontally, from any existing or proposed sewer main. Should local conditions prevent a lateral separation of 10 feet, a water line may be laid closer than 10 feet to a sewer main if:

- It is laid in a separate trench; or if

- It is laid in the same trench with the sewer mains located at one side on a bench of undistributed earth; and if
- In either case, the elevation of the top (crown) of the sewer line is at least 18 inches below the bottom (invert) of the water main.

B. Vertical Separation

- Whenever sewers must cross under water mains, the water line shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main.
- When the elevation of the water line cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the sewer.
- One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible. When it is impossible to obtain horizontal and/or vertical separation as stipulated above, both the water main and sewer shall be constructed of mechanical-joint cement lined ductile iron pipe or other equivalent based on water-tightness and by an approved method to assure water-tightness.
- Exceptions to this may be made for pre-existing conditions requiring repairs to existing piping upon approval from NPU.

1.18 ROADS TO BE KEPT CLEAN

The Contractor shall be responsible for keeping the roads clear of all spillage from trucks when hauling borrow to or hauling surplus material from the site.

1.19 ACCESS TO CUSTOMERS PROPERTY

As a condition of Service, the Customer agrees that NPU has the right of access during normal business hours to the Customer's Premises for the following purposes:

- To inspect for possible cross-connections between the Customer's equipment and facilities and the public water supply and to test the proper functioning of backflow prevention devices and for any other condition which might be hazardous or detrimental to their equipment or service to others.
- To read, inspect, repair, replace, or alter meters and accessory equipment.

The Customer agrees to provide such access by employees of NPU who have displayed proper identification.

1.20 SAFETY AT THE WORKSITE

- The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in association with the work. Work personnel and the public shall be protected by the Contractor, from all hazards connected with the construction work. Open trenches, materials, or equipment within the working limits of the public right-of-way are to be guarded using adequate barricades, certified flag people or both.

All barricades left in position overnight shall have appropriate lights or reflectors from dusk to dawn. When work narrows the useable pavement, certified flag persons shall be used to aid the flow of traffic so that there will be no undue delays. Temporary construction signs shall be erected in accordance with State and local requirements.

- B. The Contractor shall be held responsible for the safety of all work persons and the public and all damages to property from the hazard of open trenches, materials, or equipment at any time of day or night within the working area. All work shall be in conformance with applicable OSHA regulations, MUTCD guidelines, Highway Access, and permit approvals.

The Contractor shall be solely responsible for any safety citations by State or Federal inspectors. NPU shall have the authority to suspend any activity on infrastructure that does not conform to applicable regulations. Corrective action shall be taken by the Contractor.

1.21 PLANS AND DESIGN

- A. All water mains, including those not designed to provide fire protection, shall be of the following standard sizes: 4", 6", 8", 10", 12", 16", 20" or 24", and shall be sized after a hydraulic analysis has been developed based on flow demands and pressure requirements. The system shall be designed to maintain a minimum pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow. The normal working pressure in the distribution system should be approximately 60 psi and shall not be less than 35 psi. NPU may require the installation of main line Pressure Reducing Valves (PRVs) depending on system configuration.
- B. Looping of mains is required with the intent of avoiding dead-ends. Dead-ends should only be installed if looping is impractical due to topography, geology, pressure zone boundaries, unavailability of easements or locations of users; or if the main will be extended in the near future, and the planned extension will eliminate the dead-end connection. In this condition the water main extension shall be continuous to the furthest property line of the project. A dead-end water main, whether temporary or permanent, shall have a fire hydrant installed at the end, unless approved otherwise.
- C. All designs shall consider both adequate fire protection and domestic service pressure. In the event a new extension cannot meet those requirements, the Applicant or Developer shall loop the waterlines or make other approved provisions to meet the requirements.
- D. There shall be no connection between the water distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contaminating materials may be discharged or drawn into the system.
- E. No parallel underground utility (e.g., phone, electric, cable, gas) shall be designed or installed within four feet of the water main from either side or above the water main from the bottom of the main to finished grade.
- F. All work indicated on the drawings and not mentioned in the project specifications, or vice versa, and all work and material necessary to complete the work, whether or not indicated on the drawings or in the specifications, shall be considered the same as if called for both by drawings and the specifications and will not entitle the Contractor to any claim for extra compensation.

SECTION 2.0 MATERIALS

2.01 GENERAL

All materials specified shall be new, and unused, and meet the requirements specified and as required and approved by NPU. All materials shall be NSF/ANSI 61 certified.

2.02 PRODUCTS

A. PIPES and FITTINGS

- I. High Density Polyethylene (HDPE) pipe may be used for water lines eight (8) inches in diameter and less. HDPE pipe shall be manufactured in accordance with ASTM F714 and AWWA C906. Joints shall be connected by thermal butt fusion methods in accordance with ASTM D2657. HDPE pipe shall include a solid No. 12 tracer wire.
- II. Ductile-iron (DI) pipe shall be furnished in accordance with ANSI/AWWA C150 / A21.50. The ductile iron pipe shall be class 52. Pipes shall have a normal laying length of at least 18 feet. Pipes shall be double cement-lined in accordance with AWWA C104/A21.4, and receive a factory-applied interior and exterior coating of Kopper's Bitumastic Super Service Black or an approved coating of equal specifications in accordance with AWWA C151/A21.51. DI pipe joints shall be push-on type of joint that employs rubber gasket. Joints and fittings shall be in accordance with the latest AWWA C111/A21.11. Fittings shall be coated inside and outside with a bituminous asphalt paint. Pipe shall be manufactured by United States Pipe & Foundry, Griffen Pipe, Clow Pipe, Atlantic States Cast Iron Pipe, McWane or approved equal.
- III. Polyethylene (PE) pipe may be used for water lines two (2) inches in diameter and less. PE pipe shall be class 3408 in accordance with AWWA C901. Joints shall be connected by Mechanical Joints, Butt Fusions or Electro-fusion methods. Butt fusion fittings shall be manufactured in accordance with ASTM D 3261. Flanged joints require a back-up ring and require coatings and cathodic protection from corrosion. Bolting materials shall have tensile strength equivalent to SAE Grade 3. Joining plain end PE pipe to bell-and-spigot or mechanical-joint fittings or pipe; external joint restraint shall be used and an internal stiffener is to be installed in the PE pipe end. As an alternative, CTS size 200psi PE tubing may be used. Joints are to be connected using union fittings. PE pipe shall include a solid No. 12 tracer wire.
- IV. PVC pipes are not permitted without prior approval by NPU.

B. VALVES

- I. Ductile iron fittings shall have a 350 psi working pressure and shall conform to AWWA/ANSI C110/A21.10.
- II. HDPE fittings shall be manufactured in accordance with AWWA C906 and be fully pressure-rated to match the pipe pressure rating. All fittings shall be molded or fabricated by the same manufacturer as the pipe. HDPE fittings shall be joined using thermal butt fusion and/or electrofusion. Adhesives and solvent cements shall not be permitted.

- III. Pipe shall be inserted squarely into all fittings. No deflection will be allowed from any hydrant, tee, valve, or bend.
- IV. Anchor tees (aka: hydrant tees and swivel tees) shall be Class 350 ductile iron, cement-lined, conforming to AWWA/ANSI C110/A21.10, C111/A21.11, and C104/A21.4. In lieu of anchor tees, mechanical joint tees may be used if a Foster Adaptor is used to secure the valve directly to the branch of the tee. If a mechanical joint tee is to be used, it shall conform to these specifications.
- V. Mechanical joint restraints conforming to AWWA/ANSI C111/A21.11 shall be incorporated into the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe increasing its resistance as the pressure increases. Glands shall be manufactured of ductile iron and have a minimum working pressure of 350 PSIG. Twist-off nuts shall be used to ensure proper actuating of the restraining devices. Torque wrenches shall be used to tighten all bolts to manufacturer's specifications. Mechanical joint restraint devices shall be EBAA Iron MegaLug, Ford Uniflange Series 1400, Romac RomaGrip, or approved equal.
- VI. Nuts and bolts shall be Cor-Blue (or approved equal) and shall conform to AWWA/ANSI C111/A21.11.
- VII. Foster adapters shall be installed in all close-coupled connections of mechanical joint fittings and valves where a positive restraint mechanism is required. Foster adapters shall not be installed directly on hydrant shoes.
- VIII. Pipeline couplings shall conform to AWWA C110 and ANSI A21.10. Mechanical joint connecting pieces of proper diameter shall be installed in accordance with the manufacturer recommendations and at locations directed by the approved construction documents or NPU. Solid-sleeve couplings shall be used when joining new pipes or like materials. Hymax couplings may be allowed when joining dissimilar pipe materials.
- IX. All fittings shall be restrained; poly-wrapped and have concrete thrust blocks poured in place or as defined in these Specifications. Wrap all buried ductile-iron pipes, valves, and fittings with 8-mil polyethylene film in accordance with AWWA/ANSI C105/A21.5. Use only tube type for pipe. Complete the wrap prior to placing concrete anchors, collars, supports, or thrust blocks. Repair polyethylene if damaged during installation.
- X. Fittings located on the interior of vaults are to be ASME B16.1 Class 125 Flange fittings unless otherwise approved in writing by NPU. Fasteners and pipe stands on the interior of vaults shall be 316 stainless steel.

C. TAPPING SLEEVES, VALVES, AND SADDLES

- I. NPU shall be notified and must be present whenever a proposed tap is to be made on any water main.
- II. Only approved tapping companies shall be allowed to perform wet taps on water main. A current list of approved companies can be obtained from NPU.

- III. All tapping sleeves shall be provided with a $\frac{3}{4}$ " NPT test plug for hydrostatic testing of the valve and sleeve assembly. The test pressure shall be at 200 psi or not exceed the rated working pressure of any of the fittings. The sleeve and valve assembly shall hold the determined test pressure for a minimum of 30 minutes without any pressure drop. Any leaks or other problems must be remedied before the pipe is tapped. Air testing is NOT allowed on any tapping sleeve.
- IV. Direct taps over six inches (6") in diameter shall NOT be allowed. Connections that require taps larger than six inches (6") in diameter shall be tee and valve cut-ins, unless otherwise approved by NPU.
- V. Size-on-size direct taps are NOT allowed. The maximum branch size for a water main direct tap shall not be greater than one standard pipe diameter smaller than the water main diameter and no larger than six inches (6").
- VI. All Contractors (or others) shall submit complete specifications of the tapping material they intend to use at the time.
- VII. All materials used when tapping for a branch connection or interconnection from any water main shall be as specified below:
 - i. Ductile Iron Tapping Sleeves:
 - AWWA C110/C153 (latest versions) compliant ductile-iron tapping sleeves are approved for use on ductile-iron water mains when the tap is between 3" and 6" in diameter.
 - Tapping sleeves shall be of the split-sleeve design constructed with two solid half-sleeves bolted together. Sleeves shall be constructed of ductile iron, shall have a working pressure of at least 250 psi, and shall have mechanical joint ends with end and side gasket seals.
 - All bolts and nuts for mechanical joints of tapping sleeves shall be of high-strength cast iron or high-strength, low alloy steel conforming to ANSI/AWWA C111/A21.11 (latest version).
 - ii. Stainless-Steel Tapping Sleeves:
 - ANSI/AWWA C223 (latest version) compliant stainless-steel tapping sleeves are approved to be used on all NPU pipe.
 - Stainless-steel tapping sleeves shall have mechanical joint outlets and a working pressure of at least 250 psi. The stainless-steel tapping sleeve shall be TPS Triple Tap or approved equal.
- VIII. Tapping Saddles (3/4" through 2"):
 - Bodies shall be ductile iron conforming to ASTM A536. Bodies shall have a fusion bonded epoxy, or approved equal, finish.
 - Body threads shall be CC per AWWA C800.
 - Bands are to be constructed of grade 304 stainless steel and have a minimum width of 2".
 - Bolts and nuts are to be constructed of grade 304 stainless steel.

- Tapping Saddles shall be used only for ductile-iron and cast-iron pipe for taps 1-½" or 2" in size. Direct taps shall be used for ¾" and 1" taps on ductile-iron and cast-iron pipe.
- A connection made to a pipe that requires a tapping saddle or that is not ductile iron will have a body with a suitable outlet, seal, and suitable means for attachment to the main. The body shall be made to conform to the outside configuration of the main. The service saddle shall be designed to provide a drip tight connection. The body shall be Teflon- or epoxy-coated with stainless-steel strap(s), bolts, nuts, and mechanism for attaching to the pipe barrel. Service saddles with a two-inch (2") outlet shall not be used on a two-inch (2") main. Service saddles must meet manufacturers' guidelines and recommendations for specific pipe materials.

D. GATE VALVES - RESILIENT SEAT

- I. Valves shall be iron body resilient-seated gate valves manufactured to meet all requirements of AWWA C509 latest edition. Valves twelve inches (12") and smaller shall be bubble tight, zero leakage at 200 psi working pressure. Valves shall have non-rising stems, open clockwise (right) and provide a two inch (2") square operating nut with an arrow cast in the metal indicating direction of opening. Each valve shall have the maker's name, pressure rating, and year in which it was manufactured cast on the body. Valves shall be mechanical joint on each end and secured to the adjoining pipe with an approved mechanical joint restraint device. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to twice the specified working pressure. Gate valves shall be Mueller, Kennedy, AFC, M&H or approved equal.
- II. Gate valves used to convey or dispense water for human consumption shall contain no more than 0.25% lead by weighted average. Fixtures containing brass must comply with NSF/ANSI 61 Annex G.
- III. Buried gate valves shall be provided with a two-inch (2") square wrench nut and shall be installed with a cast-iron valve box as required to always allow access to the valve operating nut. In installations where the depth from grade to top of valve operating nut is greater than five feet (5'), a valve stem riser shall be provided and installed such that the depth from the valve stem riser nut to grade is from four feet to five feet (4'-5'). Valve stem risers shall be of high strength stainless steel and of welded construction.
- IV. Gate valves shall normally be placed a maximum of five hundred feet (500') apart. Tee intersections shall have three (3) gate valves directly connected to all branches with the use of Foster Adaptors (see also Section 2.02.B, Valves and Fittings). Mechanical joint cross connections (four-way intersections) shall have a minimum of four (4) valves. On longer runs of pipe, or for long runs of transmission main, valve separation of greater than 500' may be approved on a case-by-case basis.
- V. All gate valve bolts, studs and nuts shall be made from corrosion-resistant stainless steel.

- VI. Tapping valve inlet and outlet connections shall be mechanical joint unless specified otherwise on the approved construction documents for the type of pipe required for the branch or lateral pipeline.
- VII. Gate valves over twelve inch (12") diameter shall NOT be allowed.

E. BUTTERFLY VALVES

- I. Valves 12" and larger are to be butterfly valves meeting AWWA Specification C504 (latest version) Class 150B and shall have mechanical joint ends meeting the requirements of ANSI/AWWA C111/A21.11.
- II. Butterfly valves shall be manufactured by Mueller, Kennedy Valve, M&H Valve Company, Desurik, or approved equal.
- III. Iron Body Rubber Seated Butterfly Valves (buried application) at a minimum shall meet the following:
 - Valve body: Ductile Iron ASTM A536, Grade 65-45-12, 70-50-05, or 80-55-06 or ASTM A395, Grade 60-40-18.
 - Valve Disc: Ductile Iron ASTM A536 with 316 Stainless Steel seating edge to mate with the rubber seat.
 - Valve Stem: Stainless Steel ASTM A240
 - End Connection: Mechanical Joint
 - Operation: Open clockwise (right) and provide a two-inch (2") square operating nut with an arrow cast in the metal indicating direction of opening.
 - Coating: Interior and exterior to be coated with epoxy (fusion bonded).
 - All valve body bolts and nuts shall be stainless steel.
- IV. Buried butterfly valves shall be provided with a two inch (2") square wrench nut and shall be installed with a cast iron valve box as required to always allow access to the valve operating nut. In installations where the depth from grade to top of valve operating nut is greater than five feet (5'), a valve stem riser shall be provided and installed such that the depth from the valve stem riser nut to grade is from four feet to five feet (4'-5'). Valve stem risers shall be of high strength stainless -steel and of welded construction.

F. VALVE BOXES

- I. Valve boxes shall be of the three-piece cast-iron slide-type when depth to nut exceeds 7 feet and can be 2-piece cast iron slip type when depth to nut is less than 7 feet. The lower section shall be at least 5-1/4 inches inside diameter, belled or domed at the bottom to fit over the work. The upper section shall have a flanged top section to interlock in paving and shall fit over the lower section and shall be flanged at its base to provide proper bearing. The covers shall be at least 6 inches in diameter, shall fit flush with the top. Valve boxes shall be of good quality cast-iron free from all defects in material and workmanship and shall be coated with coal-tar pitch enamel or other approved coating. Valve boxes shall be "Buffalo" type suitable for the size valve on which they are used and shall be manufactured by Buffalo Pipe and Foundry, Mueller

Company, J.B. Clow & Sons, Bingham & Taylor, Inc., or equal. Valve boxes shall be plumb and centered on the nut.

- II. Valve boxes shall not transfer loads onto the valve.
- III. Valve boxes shall have a cast iron cover marked "WATER".
- IV. The boxes shall be dirt-tight with the top of the cover flush with the top of the box rim.
- V. Valve boxes located in roadways shall have one non-adjustable paving riser of a height ranging from two inches (2") to six inches (6") as needed, to be brought to final pavement grade.

G. FIRE HYDRANTS AND HYDRANT BRANCHES

- I. Fire hydrants shall be Mueller Super Centurion and shall conform to AWWA C502 with the following specifications.
 - Main Valve Opening: NPU Spec.
 - Nozzle Arrangement:
 - Two (2) 2½ inch Hose Nozzles with National Standard Thread (NST).
 - The Pumper Nozzle shall be NPU Thread.
 - Inlet Connection: Six inch (6") Mechanical Joint, "Mega-Lug" or equivalent retaining gland, and concrete thrust block. Foster adaptors shall not be used on hydrant inlet connections.
 - Operating Nut: Standard 1 ½ inch Pentagon
 - Direction of Opening: Counterclockwise.
 - Depth of Bury: Minimum four-foot six-inch (4' – 6") cover. The hydrant shall have at least 18 inches and no more than 24 inches between the bottom of the pumper cap and the ground. No more than one (1) hydrant extension is allowed.
 - Color shall be Red.
- II. Hydrants shall be compression type closing with the pressure. A breakable coupling retained in place by stainless steel or corrosion resistant pins shall make the union between the upper and lower stems. The two-piece traffic flange shall be held in place by nuts and bolts. The upper barrel shall be able to rotate 360 degrees without removing any bolts. Approved hydrant flags shall be required and placed on each hydrant at the time of installation. Wherever a traffic hazard appears to exist, curbing and/or bollards shall protect the hydrant except within City Right-Of-Ways.
- III. For single-family house subdivisions with mains 8" and above, there will be at least one hydrant at each intersection and a maximum of five hundred feet (500') between hydrants with a minimum water flow of 500 gallons per minute (gpm) at the flow hydrant with a 20-psi residual pressure at the residual hydrant. Hydrants should be located immediately adjacent to street property lines. A 20' x 20' easement will be required around all hydrants. No structures or plantings are to be placed within a 20' x 20' area of any hydrant. All approved subdivisions shall be installed with the same brand, make, and model of fire hydrant within the project limits.

- IV. Where dead-end mains occur, they shall be provided with a fire hydrant if flow and pressure meet minimum requirements. If flow and pressure are not sufficient, then an approved flushing hydrant or blow off shall be installed for flushing purposes.
- V. Hydrants shall be a minimum of two feet (2') and a maximum of four feet (4') from the edge of the sidewalk to the closest point on the hydrant when placed behind the sidewalk. Hydrants shall be located so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians.

H. HYDRANT FLOW TEST

- Prior to acceptance by NPU, Contractors/Owners shall provide a fire flow test for each installed hydrant.
- No flow tests shall be conducted without permission from NPU.
- Fire flow tests shall be witnessed and documented by NPU, and reports shall be submitted to NPU on the form provided on their website. Hydrant bands will be provided by NPU at the expense of the Contractor.

I. HYDRANT ASSEMBLIES

- I. Hydrant assemblies shall consist of either a tapping sleeve and valve or an anchor tee, a six-inch (6") mechanical joint gate valve conforming to these Specifications. The appropriate length of pipe secured to the gate valve with an approved mechanical joint restraint device, all necessary anchor couplings and approved mechanical joint restraint devices, the fire hydrant with hydrant flag, and appropriate concrete thrust block.
- II. Care shall be taken to prevent damage to hydrants and appurtenances during handling and installation. All materials shall be carefully inspected for defects in workmanship and materials; all debris and foreign material cleaned out of the hydrant bowl; all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. All hydrants shall be carefully incorporated in the water main and supported in their respective positions free from distortion and strain. Hydrants shall be set plumb. All hydrants shall be oriented to most efficiently allow fire truck access and connection for emergency purposes. Traffic model hydrants shall be installed so that the bury line is no more than two inches (2") above or below established grade. Generally, fire hydrants shall not be installed within ten feet (10') of any new or existing light pole, telephone/power pole, gas line, utility box or other utility structure. Hydrant locations are subject to the approval of NPU and the Fire Marshal. Installation procedures for fire hydrants can be found in AWWA C600.

J. BLOW-OFF ASSEMBLIES

- I. Large diameter (4" or greater) blow-off assemblies shall consist of an anchor tee, a mechanical joint gate valve, the appropriate length of Ductile Iron Cement lined, Class 52 pipe, all necessary anchor couplings, approved retaining glands, thrust block, MJ

and flanged fittings, and butterfly valve with hand lever. The open end of a large diameter blow-off shall terminate at least forty eight inches (48") above grade.

- II. NPU may require the installation of a Kupferle Eclipse #2 Post Hydrant self-draining blow-off/flushing hydrant at various points on a water distribution line. Blow-off/flushing hydrants are typically required at the end of small diameter waterlines that are not designed to support a fire hydrant. Blow-off/flushing hydrants shall be installed according to manufacturer recommendations
- III. Blow-offs shall not be connected to any sewer, submerged in any stream or ditch, or installed in any manner that will permit back siphonage into the distribution system. Blow-off shall have an adequate air gap as approved by NPU.
- IV. Blow-offs should have adequate erosion controls in place in accordance with State guidelines.

K. SAMPLING STATION

- I. Sampling stations may be required and shall be Eclipse #88-SS-R and furnished with a 3' pedestal and a 5" thick concrete pad with minimum dimensions of 36" long by 32" wide. The service connection shall be ¾" corporation, curb stop with valve box and cover.
- II. All underground piping from the water main to the sampling station shall be Type K copper. High groundwater areas may require modifications to the drainpipe height and configuration as approved by NPU.
- III. NPU will supply, install, own, and maintain the Eclipse sampling station as provided by the manufacturer. If replacement of unit is required in the future, NPU will supply the replacement.

L. COMBINATION AIR RELEASE AND AIR/VACUUM VALVES

- I. The primary functions of combination air release and air/vacuum valves are to automatically release small pockets of air as they accumulate at local high points within the water system, discharge high velocity air during main filling, and admit air during drainage. Combination air release and air/vacuum valves are to be provided at required locations as shown on approved construction documents.
- II. Combination air release and air/vacuum valves shall be designed to open positively and vent air to the atmosphere at system working pressures up to 250 psi.
- III. Combination air release and air/vacuum valves shall have reinforced nylon bodies, foamed polypropylene float, and EPDM seals.
- IV. Piping: the upstream connecting piping shall consist of two brass ball valves, one brass tee, and brass connection piping; all shall be one-inch (1") in diameter unless otherwise specified. Downstream discharge piping shall be two-inch (2") galvanized piping with appropriate fittings.

- V. The open end of an above grade combination air release and air/vacuum valve venting pipe shall terminate at least forty-eight inches (48") above grade and be fitted with an insect screen on the end.
- VI. Automatic air relief valves shall NOT be used in situations where flooding of the access-way or chamber may occur.
- VII. Valves shall be A.R.I D-040 or approved equal. All air release valves shall conform to ANSI/AWWA C512.

M. PRESSURE REDUCING VALVES

- I. Pressure Reducing Valves (PRVs) shall be; Cla Val 90-01/690-01 with positioning stems, containing the check valve feature (unless otherwise stated); Flomatic Model C101 with position indicator stem; or approved equal.
- II. Pressure reducing valves shall be set horizontally and be connected to a flanged pipe on the incoming side and a dismantling coupling on the downstream side.
- III. Pressure reducing valves are to be installed in precast concrete vaults that allow adequate space for removal and maintenance. Vaults shall also have access hatches that are sized appropriately for the insertion and removal of all components. Vault designs shall be subject to approval.
- IV. To prevent fouling of the pressure reducing valves during water main filling and flushing, a temporary spool piece may be installed in place of the PRV.
- V. The adjustment range for the pressure reducing valve must be approved by NPU prior to ordering.

N. MANHOLES AND VAULTS

- I. Precast manholes and vaults shall conform to ASTM C478 and ASTM C858, as applicable.
- II. All manholes and vaults shall be designed by a professional engineer addressing design criteria, such as, but not limited to wheel loading, thrust restraint, buoyancy, soils, wall penetrations, access, etc. Manholes and vaults shall be designed for loads in accordance with ASTM C890 and ASTM C857, as applicable.
- III. Sections shall have tongue and groove joints with butyl mastic rope installed between sections.
- IV. The exterior of all sections shall have a bituminous coating. Drainage from the manhole or vault shall be designed to run to daylight whenever possible.
- V. Manhole top sections shall be eccentric except that the concentric flat top sections shall be used where shallow cover requires a top section less than three feet (3') deep.
- VI. Vault top sections shall have a site-specific design and be appropriate for the application.

- VII. Precast bases, cast-in-place bases, or precast bases integral with base sections may be used.
 - VIII. Cement shall be Type II Portland Cement, conforming to ASTM Designation C150.
 - IX. Ships ladders shall be required for vaults.
 - X. Ladder rungs for manholes shall be aluminum alloy 6061-T6 in accordance with ASTM designation B221. Rungs shall be set in precast sections during casting of section or grouted with a non-shrink grout. Plastic coated steel ladder rungs secured in the walls of the precast structure shall also be acceptable. Rungs shall be aligned to allow access from the top of the manhole to the base in a vertical line.
 - XI. All manholes and vaults shall be equipped with an approved "ladder-up" safety device.
 - XII. Brick or masonry shall NOT be used to raise the manhole or vault frame cover to grade. Only concrete grade rings shall be allowed for this function.
 - XIII. All sections shall be cured by an approved method. Sections shall not be shipped or manhole rungs subjected to loading until the concrete has attained a compressive strength of 3,000 psi or until 5 days after fabrication, whichever is the longer.
 - XIV. Precast concrete manhole and vault manufacturers shall incorporate flexible pipe sleeves within the construction of the manhole in such size to accommodate the size pipe being used. Link seal may be required in place of flexible pipe sleeves.
 - XV. In no case shall a manhole be constructed such that it bears directly or indirectly on the pipeline or any appurtenances thereof.
 - XVI. All joints, lift holes, and other openings inside and outside the manhole shall be filled with water plug to prevent leakage.
 - XVII. All precast concrete structures shall be tested for watertightness after installation and prior to backfill. Manholes shall be vacuum tested in accordance with ASTM C1719. The test shall be performed by personnel that have been trained with the equipment and the test. The vacuum test must hold 4 inches of mercury for a minimum of 5 minutes in order to pass.
- O. MANHOLE AND VAULT FRAME AND LID
- I. All manholes shall be provided with ductile iron manhole frames and lids of the size and type as required in the approved construction documents.
 - II. Frame and lid shall be one of the following:
 - Standard frame and lid: Non-rocking design with a solid infiltration resistant lid.
 - Waterproof frames-bolted lids: Waterproof frames shall have a solid lid with machined bearing surfaces and sealed with a rubber gasket. Lid shall fasten securely to the frame with countersunk bronze hexagonal-head cap screws.

Frame shall be supplied with anchor bolts and bolt holes. Manhole frame and lid shall be Neenah No. R-1915-F (Type L) or equal.

- Hinged frame and cover: Hinged frames and covers shall incorporate a blocking feature to prevent accidental closure. The cover must be removable if required. Hinged frames and covers may be used in off-road locations, or in traveled ways with approval of NPU. Hinged frame and cover units shall be Pamrex, Bilco, or approved equal.
- Manhole lids for manholes on buried water mains shall have the word "WATER" cast into the top surface.

P. CONCRETE THRUST BLOCKS

- I. Concrete shall be Portland Cement concrete of 3000 psi minimum 28-day compressive strength. ASTM C94 specification for transit mixed concrete shall control the concrete quality. A maximum water cement ratio of 6 gallons per sack and a maximum slump of 4 inches will be allowed.
- II. Concrete shall be clean and not mixed with other material, including previously prepared concrete products.
- III. Thrust blocks shall be installed on caps, tees, hydrants, and bends of 22.5 degrees and greater. All other bends less than 22.5 degrees shall be restrained by use of mechanical joint restraint devices on each end of each bend.
- IV. A Professional Engineer shall design thrust restraint for waterlines 12" or greater.
- V. Poured-in-place thrust blocks shall be neatly formed with wooden side forms. Thrust blocks shall be formed against undisturbed soil.
- VI. Precast thrust blocks may be approved by NPU on a case-by-case basis. The bearing surfaces of precast thrust blocks shall be filled with compacted crushed gravel to undisturbed soil.
- VII. Blocking shall be placed on all sides of each fitting in the direction of thrust and not underneath for use as a foundation or support.
- VIII. Thrust blocks shall be cured for a minimum of 5 days before being subjected to line pressure.
- IX. All ductile-iron fittings shall be polyethylene-wrapped prior to pouring any concrete. Concrete shall not overlap any joints and/or glands, hence restricting future access to nuts and bolts. Adequate form work shall be employed to prevent such overlap.
- X. Where directed, concrete in-line thrust restraint may be required. In-line thrust restraint shall be designed by a licensed professional engineer where required on the plans or as directed.
- XI. NPU shall inspect all thrust blocks prior to backfilling.

SECTION 3.0 CONSTRUCTION METHODS

3.01 EXISTING IMPROVEMENTS

The Contractor shall maintain in operating condition and protect from damage all existing improvements, including utilities, roads, streets, sidewalks, drives, power and telephone lines, gas lines, water lines, sewers, gutters and other drains encountered, and repair to the satisfaction of NPU any aerial, surface or subsurface elements damaged during the work. Where and if shown on the plans, the locations and existence or nonexistence of underground utilities are not guaranteed. The Contractor shall contact Call Before You Dig to determine and/or verify such information prior to proceeding with the work. The Contractor shall make reasonable and satisfactory provisions for the maintenance of traffic on streets, drives, walkways and at street crossings and if necessary to provide temporary walkways and bridges for crossing of the open trench as directed. Work shall not commence within the City's rights-of-way until a Right-of-Way Encroachment Permit is obtained from the Public Works Department.

3.02 DISPOSAL AND REUSE OF MATERIALS

All materials resulting from excavations and approved as suitable by NPU may be used for backfilling, filling, embankments, and such rough grading as is required. All excavated materials not approved for backfill and fill, all surplus material, and all rock resulting from rock excavation shall be removed and disposed of at the Contractor's expense.

3.03 CONTROL OF WATER

The Contractor shall always maintain the excavations free from water so that all construction work shall be performed under dry conditions unless otherwise authorized by NPU. Water resulting from draining and pumping operations shall be disposed of in an approved manner so as not to damage or disturb existing construction or property or the new construction and to prevent interference with adjacent property and prevent hazardous conditions. Any material which becomes unsuitable as a result of the Contractor's lack of dewatering or improper dewatering shall be removed by the Contractor and replaced with gravel fill at the Contractor's expense, as directed and approved by NPU.

Grading shall be accomplished to prevent surface water from flowing into excavations.

3.04 EROSION CONTROL

- A. The Contractor shall construct and maintain all erosion control measures in accordance with the Connecticut Guidelines for Soil Erosion and Sediment Control, current edition. The Contractor shall carry out project construction in such a manner as to give adequate protection of water courses and minimize surface erosion.
- B. The Contractor shall perform all erosion control measures as indicated on approved plans and specifications, including installation, maintenance, and removal of temporary dams and inlet protection.
- C. Dust shall be controlled through the application of calcium chloride or water, as required by the City.

3.05 EXCAVATION

- A. No trench containing a water main or connection to the water main shall be backfilled until NPU has completed an inspection and approved the work. The water level in the trench shall be maintained at a level below the water connection before the cap is removed and while the connection is being made and until such time as it has been inspected, approved and backfilled.
- B. All excavations shall be adequately guarded with barricades and lights so as to protect the public from hazard. Streets, sidewalks, parkways, and other public property disturbed in the course of the work shall be restored in a manner satisfactory to NPU.
- C. All excavations shall be performed to the depths indicated on the drawings or as detailed in these Standards. Excavation shall be made by the open cut method except as otherwise specified or shown on the drawings. Excavation methods shall meet or exceed all Occupational Safety and Health Administration (OSHA) construction industry standards.
- D. All excavated materials not required for fill or backfill shall be removed and wasted as directed. The banks of shallow trenches shall be kept as nearly vertical as practicable and where required shall be properly sheeted and braced. Except where otherwise indicated, trench bottoms shall be not less than 12 inches wider nor more than 16 inches wider than the outside diameter of the pipe to be laid therein, and shall be excavated true to line, so that a clear space of not less than 6 inches nor more than 8 inches in width is provided on each side of the pipe.
- E. The bottom of trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints. Bell holes shall be dug after the trench bottom has been graded. Bell holes shall be excavated only to an extent sufficient to permit accurate work in the making of the joints and to ensure that the pipe, for a maximum of its length, will rest upon the prepared bottom of the trench. Depressions for joints other than mechanical shall be made in accordance with the recommendations of the joint manufacturers for the joint used.
- F. Excavation operations adjacent to or around existing structures, pipelines, and utilities shall be done manually and, in a manner, to prevent the disturbance of or damage to the existing structures, pipelines, and utilities. Graded gravel bedding shall be provided for existing utilities in trenches where and as directed by NPU.

3.06 GRADING AND STACKING

- A. All grading in the vicinity of trench excavation shall be controlled to prevent surface ground water from flowing into the trenches. Any water accumulated in the trenches shall be removed by pumping or by other approved methods. During excavation, material suitable for backfilling shall be stored in an orderly manner a minimum distance of one and one-half times the depth of the excavation back from the edges of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling, as determined by NPU, shall be removed from the job site and disposed of by the Contractor

in a manner as approved by the Engineer. In no case shall earth be dug up by machinery nearer than 6 inches to the finished bottom of the excavations; the last 6 inches of the excavations shall be removed by pick and shovel and accurately graded to the lines and grades indicated and/or as directed.

- B. Approved material to be used for backfilling, which is piled along the trenches, shall be piled in an orderly manner from the banks of the trench to avoid overloading and to prevent cave-ins. The excavation, sheeting, shoring, bracing and dewatering operations shall be carried out in such a manner as to prevent the undermining or disturbing of existing pipelines, utilities and structures, or any completed construction of this project.
- C. If unsuitable bearing material is encountered at the trench bottom, the Contractor shall immediately notify NPU and shall not proceed further until instructions are given; unsuitable material shall be removed to the lines and grades directed by NPU and the resulting excavations refilled to the proper grade with thoroughly compacted graded gravel or bank gravel as directed.

3.07 BACKFILLING AGAINST MASONRY OR CONCRETE

Backfilling against masonry or concrete shall only be done when approved. Backfilling against concrete other than encased pipelines within 7 days after placement will not be allowed. Symmetrical backfill loading adjacent to structures shall be maintained. During backfilling and compacting operations, care should be exercised so that equipment used will not overload the structures. Backfill adjacent to structures shall be placed in layers not more than 9 inches in loose depth, and each layer thoroughly compacted with at least 4 passes of an approved plate-type vibratory compactor.

3.08 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. The Contractor shall notify Call Before You Dig two (2) working days prior to excavation, and otherwise comply with all permit requirements.
- B. Wherever culverts, sewers, drains, manholes, catch basins, storm drains, water mains and services, water valves or curb stops, electric, gas, telephone or cable TV conduits, utility poles, overhead lines or other existing facilities are encountered, they shall be protected and firmly supported by the Contractor until excavation is backfilled and the affected structures are made secure. Injury to such structures caused by or resulting from the Contractor's operations shall be repaired at the Contractor's expense within a time period that will not place an unreasonable burden on the users.
- C. Any water distribution component damaged during excavation shall be replaced with an in-kind material or a material approved by NPU.
- D. All materials used for the repair of an existing water main shall be disinfected in accordance with AWWA C651. Repairs shall be made so as to have the water service interrupted for as short a period of time as possible.
- E. No excavation shall be left open and unattended. All unattended excavations shall be completely backfilled to grade with adequate protection around the excavation site, as approved NPU.

- F. Approval for relocation of any existing facilities shall be obtained from the appropriate party and/or the City or NPU prior to relocation. The Contractor shall be responsible for the work and for providing notice to users before planned interruptions of service.
- G. In the case of reconstruction of existing facilities or disruption due to the installation of new utilities, the Contractor/developer/owner shall be required to upgrade impacted portions of the existing water system to these Specifications. These upgrades shall also be required when new construction impacts existing infrastructure.
- H. It is the intent of NPU to address all conflicts during the design stage of a project, however, field changes may be required at the discretion of NPU.

3.09 GENERAL CONSTRUCTION

- A. At least fourteen (14) days before the start of actual construction of any utilities or improvements, the Applicant, Engineer, Owner, or Contractor shall notify NPU of their intent to proceed, and shall arrange a pre-construction meeting with NPU staff, Applicant, Engineer, and the Contractor to discuss the project. Pre-construction meetings shall take place a minimum of five (5) days prior to the start of the actual work.
- B. Contractors shall notify Call Before You Dig at least two (2) working days prior to any work on the water system.
- C. The Contractor shall be responsible for the conduct and discipline of his employees and/or any Subcontractor or persons employed by Subcontractors. All workers must have sufficient knowledge, skill, and experience to perform properly the work assigned to them. Tools shall be adequate for the work and in good condition to produce good, clean-cut ends and threads of the correct size, pitch, and taper.
- D. If, at any time during construction, NPU feels that improper materials, equipment, labor, safety provisions or traffic control are being utilized, NPU may direct verbally and/or in writing that the situation be corrected at once. If the situation is not corrected, NPU may implement a stop work order. This may cause further construction to be terminated pending compliance.
- E. The Applicant, Developer, or Owner shall provide construction inspection under the responsible charge of a Connecticut-licensed Professional Engineer. NPU may require either part- or full-time inspection (at their option) of the work, to see that these Specifications are followed. The cost of this inspection shall be paid by the Contractor.
- F. NPU reserves the right to direct the Contractor to uncover any installation not meeting these requirements or that has been installed without prior approval or inspection, at the Contractor's expense.
- G. Any Contractor who does not maintain local headquarters must make satisfactory arrangements with NPU to service emergencies or complaints which may occur at night, over the weekend, or when the job is shutdown (these arrangements shall include road maintenance and repairs). The Contractor shall provide NPU with emergency contact telephone numbers. The Contractor shall be responsible for any costs associated with these services.

- H. Temporary water lines may be required as appropriate for existing water Customers and must remain in service until a new water main has been tested, disinfected, and accepted by NPU.
- I. Planned water outages during a project that impact existing Customers shall first be coordinated with and approved by NPU, with a minimum of five (5) working days' notice. All work shall be performed to minimize planned water outages to existing water Customers to the greatest degree possible.
- J. At least five (5) working days in advance of a planned shutdown of any service line, notices must be delivered to all affected Customers. Due to the nature of certain business activity, planned shutdowns may be required to be scheduled after normal working hours.
- K. Prior to the date of acceptance by the system Owner, the Contractor shall replace any new pipe or accessory found to be defective at any time, at no expense to the system owner.
- L. There shall be no physical connection between the distribution system and any pipes, pumps, hydrants, or tanks that are supplied with water that is, or may be, contaminated.
- M. Excavated material shall be placed in a manner that will not obstruct the work nor endanger the workers or the public, or obstruct sidewalks, driveways, roadways, or other structures. Excavated materials shall be placed in compliance with federal, state, or local regulations.
- N. All surplus material and debris shall be removed as the project progresses, leaving all areas clean and presentable.
- O. Unless otherwise required, all paving and sidewalks that may be damaged during construction shall be replaced with the same kind of material that previously existed.
- P. All areas within the limits of the approved construction documents shall be loamed and seeded. This shall include areas of new construction, except as the actual area occupied by structures, roads, parking areas, and walks, and shall include areas of established landscape and flora through which the work may pass where grassed areas are affected. Areas to be seeded may have subgrade placed at any time of the year. However, placement and preparation of loam (topsoil) and seeding shall be performed only between the dates of April 15 and October 15, or as approved otherwise by NPU. Eroded areas shall be graded to specific contours prior to loaming or seeding.
- Q. The Contractor will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury, or loss to all employees and other persons who may be affected, materials or equipment to be incorporated, whether in storage on or off the project site, and other property at the project site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation or replacement in the course of construction.
- R. The Contractor will comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction within the project area. The Contractor will erect and maintain all necessary safeguards for safety and protection. He will notify

owners and adjacent utilities or properties when prosecution of the project may affect them. The Contractor will remedy all damage, injury or loss to any property caused, directly or indirectly by work associated with the project. In emergencies affecting the safety of persons or the project, or property at the site or adjacent thereto, the Contractor shall act to prevent threatened damage, injury, or loss.

- S. Prior to commencement of any project, the Contractor shall provide construction signage and traffic control plans in accordance with the Manual of Uniform Traffic Control Devices to the appropriate public works official of each community. Adequate notification must also be given to landowners that may be affected by traffic changes.
- T. Emergency vehicle and school bus assess shall be coordinated with the appropriate City and State officials.

3.10 INSTALLATION OF WATER MAINS AND APPURTENANCES

- A. Materials and equipment shall be stored to ensure the preservation of their quality and fitness for the work. Stored materials and equipment to be incorporated into the work shall be located to facilitate prompt inspection by NPU personnel.
- B. When unexpected subsurface conditions or conflicts with underground infrastructure are encountered that could affect the designed water line project, the Contractor must report the changed conditions to the design/project engineer and NPU before the work is allowed to proceed.
- C. NPU shall be notified in advance to inspect all mechanical joint fittings, main line taps, appurtenances, thrust blocks, and water line crossings prior to occurrence of back filling.
- D. The water main shall be laid and maintained on lines and grades established by the contract documents for the project, or as defined within these Specifications. Fittings and appurtenances shall be installed at the required locations unless approved otherwise by NPU.
- E. Prior to excavation, an investigation may be required to determine the location of existing underground structures, utilities and conflicts. Test holes may be required.
- F. All pipes, fittings, valves, hydrants, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for final disposition.
- G. All pipes showing cracks shall be rejected. If cracks occur in the pipe, the Contractor may, at their own expense and after approval of NPU, cut off cracked portions at a point at least twice the pipe diameter from the visible limits of the crack and use the sound portion of the pipe.
- H. Care shall be taken to prevent damage to valves and other appurtenances during handling and installation. All debris and foreign material shall be cleaned out of valve openings, etc. All operating mechanisms shall be operated to check their proper functioning, and all other nuts and bolts checked for tightness. Valves and other equipment, which do not operate easily, or are otherwise defective, shall be replaced. All valves shall be carefully

incorporated into the water main and supported in their respective positions free from all distortion and strain.

- I. Valves and valve boxes shall be set plumb. Valve boxes, besides being plumb, shall be centered directly over the valve nut.
- J. Repairs on any damaged newly installed pipe shall include two restrained couplings and an appropriate length of pipe of the same material as that which was broken or approved equal.
- K. All water mains shall have no less than four and a half feet (4.5') of cover over the top of the pipe unless waived by NPU. Each pipe shall be laid to form a close joint with the next adjoining pipe and to bring the inverts continuously to the required grade. Water mains shall not have more than eight feet (8') of cover over the top of the pipe unless conditions require and approved by NPU. Detectable warning tape shall be placed 24" above the top of the pipe and laid continuously over all mains and service lines.
- L. Temporary support, adequate protection, and maintenance of all underground structures, drains, sewers, and other obstructions encountered in the progress of the work shall be always provided. If utility service is interrupted because of work for the project, the Contractor shall immediately restore service by repairing the damaged utility at the Contractor's expense.
- M. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing, or other materials shall be placed in the pipe at any time. Approved end caps shall be utilized to prevent material from entering the pipe.
- N. At all times, when pipe laying is not actually in progress, the open ends of the pipe shall be closed by temporary watertight plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until all danger of water entering the pipe has passed and water levels are at least one foot (1') below the invert of the pipe. During construction, the Contractor shall conduct operations to prevent the accumulation of water, ice, and snow in the vicinity of excavations or in the vicinity of excavated areas, and to prevent water from interfering with the progress and quality of the work. Under no conditions shall water be allowed to rise in open trenches after the pipe has been laid.
- O. Accumulated water, ice, and snow shall be promptly removed and disposed of by pumping or other approved means. Disposal shall be carried out in a manner that will not create a hazard to public health, nor cause injury to public or private property, work completed or in progress, or public streets. Disposal shall not cause any interference in the use of streets and roads by the public. Disposal may also require protection of storm drain facilities. Pipes under construction shall not be used for drainage of excavations.
- P. When a pipe material is specifically noted on the approved project drawings, the Contractor/developer shall not have the option of utilizing any other pipe material.
- Q. Galvanized pipe or fittings shall not be used in any water system managed or owned by NPU. Any lead service lines or appurtenances including goosenecks encountered during construction shall be replaced with lead-free components in accordance with State and

local requirements. NPU shall be notified immediately upon encountering a leaded component.

- R. If the trench passes over a previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.
- S. When the excavated material is found to include ashes, cinders, refuse, organic material, or other unsuitable material, this material shall be removed to a minimum of at least twelve inches (12") below the bottom and each side of the pipe. The removed material shall be replaced with clean, stable, compacted backfill material as approved by NPU.
- T. The proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of pipe installation. All pipe, fittings, valves, and hydrants shall be lowered carefully into the trench using a backhoe, crane, tagged lifting chains, or other suitable tools or equipment, in such a manner as to prevent damage to water main materials and protective coatings and linings.
- U. All dead ends of new mains shall be closed with plugs or caps; such dead ends shall be equipped with suitable blow-off facilities and thrust restraints.
- V. Any deflection of joints in pipe shall be within the limits specified by the manufacturer.
- W. Restrained joint pipe systems shall be designed by a Professional Engineer. Combined thrust block and restrained joint systems shall be designed independent of the other.

3.11 PIPE BEDDING AND BLANKET

- A. All excavated installations of pipeline shall be installed in accordance with AWWA C600, C605 Type 5 Laying Condition. In all cases, clearance surrounding the pipe shall be at least six inches (6") below and eighteen inches (18") on all other sides for nominal pipe sizes up to 24". A twelve-inch (12") layer of blanket material shall be placed above the pipe. See the Typical Trench Detail.
- B. No pipe shall be laid directly on ledge, hard shale, or a very compact glacial till. When excavation of rock is necessary, all rocks shall be removed to provide a clearance below all pipes, valves, and fittings. When excavation is completed, a layer of appropriate backfill material shall be placed on the bottom of the trench to the appropriate depths, then leveled and tamped. These clearances and bedding procedures shall also be observed for pieces of concrete or masonry and other debris that may be encountered during excavation. In all cases the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection, or point of material of sufficient size that could cause a fulcrum point or point load.
- C. When an unstable trench bottom is encountered and NPU determines that it cannot support the pipe adequately, an additional depth shall be excavated and refilled to the pipe invert with approved material at the Contractor's expense.
- D. Pipeline trenches shall be dry during the laying of pipe. Wood supports under pipe shall be removed prior to back filling.

- E. Blanket material shall be tamped in layers around the pipe to at least twelve inches (12") above the pipe to adequately support and protect the pipe.
- F. Bedding and blanket material shall be Class II material (ASTM D2321) consisting of clean, granular material (sand), particle size limits described as follows:

<i>Sieve Percent</i>	<i>Passing</i>
No. 4	100%
No. 100	30%
No. 200	10%

3.12 ROCK EXCAVATION

- A. Areas of known or suspected ledge may require subsurface investigation to determine its extent prior to job commencement, at the Contractor's expense A pre-blast survey is required and shall be conducted prior to any blasting, and a written blasting plan shall be provided to NPU prior to any blasting. The pre-blast survey may include photographs and video of existing conditions. The contractor must submit a Blasting Investigation Report (available on NPU website). NPU will review the documentation and provide written authorization to the contractor to proceed. NPU must receive this information a minimum of two (2) business days in advance of blasting.
- B. NPU will perform a leak check on buried all utility mains before and after blasting to ensure system integrity and public safety.
- C. Rock shall be excavated, when encountered, to the lines and grades indicated on the drawings or as directed by NPU. Excavated material shall be disposed of and acceptable material shall be furnished for backfill in the space voided by the excavated rock.
- D. Rock in pipe trenches shall be removed to provide a clearance below the pipe, valves, and fittings of twelve inches (12") and on all sides of at least eighteen inches (18"), see typical detail. When so specified or indicated, or when laying the pipe in an excavated rock area, the trench shall be backfilled with satisfactory material listed and approved under Pipe Bedding and Blanket (see typical Pipe Trench detail). Specified clearances shall be maintained between the bottom of the pipe and any part, projection, or point of rock, boulder, or stone of sufficient size and placement that could cause a fulcrum point or point load.
- E. Blasting shall be in full compliance with all State and Federal laws and local ordinances. Blasting Contractors shall provide a certificate of insurance and take all possible care to avoid injury to people and damage to property. Blast areas are to be completely covered with blasting mats and sufficient warning given to all people in the vicinity of the work before blasting. Care shall be taken to avoid damage to utilities or other structures above and below ground.
- F. All blasting shall be conducted by those qualified and experienced in drilling and controlled blasting procedures for rock excavation of the types required. People responsible for blasting shall be licensed blasters in the State of Connecticut and shall have had acceptable experience in similar excavations in rock and controlled blasting

techniques. Drillers shall have demonstrated proficiency in collaring and drilling holes precisely. NPU shall be notified in advance of all drilling and blasting around existing transmission and distribution mains.

- G. No blasting will be permitted under or adjacent to any street, road, or highway unless permission has been received in writing.
- H. Blasting Contractors shall comply with all municipal, State, Federal and other ordinances and codes relating to the storage and handling of explosives. Particular attention is called to adherence of requirements of the electric, gas and other utilities that may be located in the project area.
- I. Damages and costs of whatever nature resulting from blasting operations shall be borne solely by the blasting Contractor.
- J. If rock below grade is shattered by blasting, caused by holes drilled too deep, or too heavy charges of explosives, or any other circumstance due to blasting, and if such shattered rock does not provide suitable foundation, the rock shall be removed and the excavation refilled with acceptable material by and at the expense of the Contractor.

3.13 BACKFILLING

- A. Trenches shall be backfilled above blanket material to subgrade with, wherever possible, material excavated from the trench, provided the material consists of loam, sand, gravel or other suitable material and shall be done only after the approval of NPU. Material for backfilling shall be free of roots, stumps, and frost. Backfill shall not be placed on frozen material. Materials used for backfilling trenches shall be free of stones larger than six inches (6") in the longest dimension. No stones measuring over one inch (1") in the longest dimension shall be placed within one foot (1') of the pipeline being backfilled. Stones found in the trench shall be removed for a depth of at least twelve inches (12") below the bottom of the pipe. In general, use of blasted rock, as backfill will not be permitted. Any materials excavated from the site not conforming to these Specifications shall be disposed of and replaced with approved material by the Contractor, as required.
- B. Backfill for pipelines under roadways shall be placed in six-inch (6") lifts, each lift being compacted to not less than 95% of maximum dry density as determined by Method D of ASTM Designation D 1557-66T or latest edition. Pipelines outside of roadways or in cross country routes shall be compacted to 90% maximum density as determined by Method D of ASTM Designation D 1557-66T or latest edition. If conditions warrant, the backfilling of trenches may be done with mechanical equipment. Precautions shall be taken in the placement and compaction of the backfill material in order not to damage the pipe, pipe coating or structure. The backfill shall be brought up evenly. Around valve boxes, the backfill shall be tamped to four feet (4') on all sides of the box, or to the undisturbed trench face, if less than four feet (4'). Backfilling in all public roadways shall be so compacted as to leave no depression in the road. Additional backfill requirements may apply within State or local Highway rights-of-way. All public road surfaces shall be restored to a condition at least equal to that which existed prior to the start of construction unless approved otherwise by the appropriate public works or street department authority. Precautions shall be taken against undue damage to existing surface materials.

- C. No compacting shall be done when the material is too wet to be compacted properly. At such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compaction, or such other precautions are taken as may be necessary to obtain proper compaction. Surplus excavated materials shall be disposed of in a satisfactory manner. Surplus material or spoil shall be removed promptly and disposed of so as not to be objectionable to abutters or the public.
- D. Trenches that have been improperly backfilled, enclosed or covered before inspection of fittings and joints shall be reopened and re-backfilled at the Contractor's expense.
- E. Flowable fill may be allowed at the discretion of NPU and if designed by a Licensed Professional Engineer.

3.14 RESURFACING OF ROADWAYS

- A. It shall be the responsibility of the Contractor to obtain from the State or City authorities all required permits for cutting roadway pavement, and to provide the work of replacement of pavements in accordance with all requirements of the controlling authorities, in addition to these Specifications. All work damaged or displaced because of the Contractor's operations shall be repaired or replaced and restored by the Contractor in a manner satisfactory to NPU, and to the proper State, City or Town officials at the Contractor's expense.
- B. In case of settlement or other defects in replaced pavements, the Contractor shall cut out, replace, restore or repair the damaged pavements, in a manner satisfactory to NPU, at the Contractor's expense.
- C. The Contractor shall, at all times, maintain the pavements in a safe and satisfactory condition. All maintenance and repair of pavements shall be subject to approval of NPU and the controlling State and City authorities.
- D. Suitable power rollers shall be used to obtain compaction. Finished pavement surfaces shall finish even with adjacent existing pavement and be free from surface irregularities. No vibration rollers shall be used over Cast Iron mains.
- E. Subgrades for roadway pavements shall be prepared by shaping and compacting to the lines indicated and to the proper grade, to receive the full thickness of the base and surface courses. Completed subgrades shall be protected and shall be approved prior to the placing of any gravel base courses; gravel base courses shall not be placed on frozen or muddy subgrade. The edges of existing pavements shall be cut back to obtain clean, sound, vertical, edges of the original pavement; edges of bituminous concrete shall be coated with an approved bituminous tack coat for proper bonding of new pavement construction with the existing pavements.
- F. Construction of temporary and permanent resurfacing at backfilled trenches in existing roadways shall be provided to the details indicated on the drawings, as specified and directed. The work shall include preparation of sub-grade, providing compacted gravel base, bituminous tack coat, and bituminous pavement, as required.

- G. Permanent pavement construction shall be deferred for a period of at least 30 days after the completion of the construction of the temporary bituminous pavements specified, unless otherwise directed in writing by NPU. Following the removal of the temporary pavement and sufficient rolled gravel base,
- H. Other surfacing disturbed by the Contractor's operations shall be replaced in kind unless otherwise directed by NPU.

3.15 RESURFACING OF AREAS OTHER THAN ROADWAYS

Areas excavated for the installation of the water mains and appurtenances, which are not in roadways, shall be returned to their original condition by the Contractor at his own expense with approved materials.

SECTION 4.0 PRESSURE TESTING AND DISINFECTION

4.01 PRESSURE TESTING

- A. Prior to any pressure testing or disinfection, the Contractor shall submit to NPU a plan of proposed methods and materials. The plan must be approved prior to any testing or disinfection of the system.
- B. Where connections are to be made between new water mains and existing water mains, the Contractor shall take all precautions to prevent contamination to existing potable water lines. No trench water, mud or other contaminating substances shall be permitted to enter the pipeline. **All connections between new mains and existing mains shall be made only after water sample testing of the new water main has been approved by the NPU Testing Laboratory.** Connections of new work to existing appurtenances shall be provided in accordance with the printed recommendations of the respective manufacturers and as approved by NPU.
- C. All pipelines shall be tested, by the Contractor, under the direction of NPU, as soon as possible after installment. All materials and equipment required for testing shall be supplied by the Contractor. Pipelines shall be filled with water; care being taken in the filling process to eliminate all air pockets and bubbles. After the pipelines have been filled, and all air released, the pressure on the piping shall be increased until the test pressure has been attained. Pipe, fittings, or valves found defective shall be replaced and all leaking joints shall be made tight, by the Contractor, as directed by NPU. The tests shall be repeated as often as necessary, at the Contractor's expense, to assure NPU that all piping, valve, and appurtenances are free of defects and that all joints are tight.
- D. Unless otherwise permitted the testing shall be performed after either backfilling or partially backfilling the completed pipelines or sections thereof. Before testing, the Contractor shall submit, in writing, to NPU, his proposed method of testing the completed pipeline. Testing shall begin only after approval by NPU of the proposed methods. Testing of water mains shall be performed by the Contractor at his expense as witnessed by NPU for approval. Any required coordination with NPU shall be the responsibility of the Contractor.
- E. Pressure testing and leakage testing shall be carried out in accordance with ANSI/AWWA C600.
- F. All new sections of water main shall be hydrostatically tested. "Pressurization" and "air removal" shall be accomplished as specified in ANSI/AWWA C600. After the test pressure is applied, any defective pipe, fitting, valve or hydrant discovered in consequence of this pressure test shall become the property of the Contractor and shall be removed from the job site and replaced at the Contractor's expense with sound material. The test shall be repeated until satisfactory to NPU.
- G. A leakage test shall be conducted concurrently with the pressure test. The Contractor shall furnish the gage, pump, connections and all the necessary apparatus and shall furnish the necessary assistance to conduct the test.
- H. The testing pressure shall be at 200 psi maximum.

- I. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
- J. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148,000}$$

Where:

- L = allowable leakage, in gallons per hour
- S = length of pipe tested, in feet
- D = nominal diameter of the pipe, in inches
- P = average test pressure during the leakage test, in PSI

- K. No testing will be allowed against closed valves.
- L. When hydrants are in the test section, the test shall be made against the open hydrant valve.
- M. If any test of pipe laid discloses leakage greater than that specified above, the Contractor shall, at his own expense, locate and repair the defective materials until the leakage is within the specified allowance.
- N. All visible leaks shall be repaired regardless of the amount of leakage.
- O. Any temporary thrust restraint required for testing sections of completed water main installation and later removed as directed by NPU shall be provided by the Contractor at no additional cost to NPU.

4.02 DISINFECTION

- A. Disinfection shall be carried out in accordance with ANSI/AWWA C651 under the direction of NPU, using the continuous feed method.
- B. The Contractor shall submit to NPU for approval prior to disinfection the type of chlorine to be used, the disinfection experience of the workers, and the procedures and equipment to be used. Water main disinfection shall be only accomplished by specially trained personnel.
- C. Mains shall be completely flushed before and after the hydrostatic test until all evidence of sediment is removed. A hypochlorite solution shall be applied, with a proper regulating device at the beginning of the pipe section to be disinfected, through a corporation stop in the newly laid pipe. Hypochlorites utilized in this work shall meet the requirements of AWWA B300.
- D. Water from the existing distribution system entering the newly laid pipe through a suitable backflow preventor shall be controlled to flow slowly during the application of hypochlorite. The rate of hypochlorite application shall be in such proportion to the rate

of water flowing through the pipe that the treated water entering the newly laid pipe will have a concentration of free chlorine residual of 25 parts per million (mg/L)

- E. When disinfecting newly laid water pipe involving more than one valved section, all valves shall be operated while the pipeline is filled with disinfection water. Hydrants and other appurtenances shall also be operated for disinfection.
- F. There shall be a retention period of at least 24 hours and preferably more. The non-spore-forming organisms shall be destroyed and the chlorine residual after the retention period and at the extremity of the pipe shall be at least ten parts per million per NPU Testing Laboratory.
- G. The Contractor shall be responsible for satisfactory disposal of all flushing water and chlorinated water at no additional expense to NPU. The Contractor shall consider the impact of highly chlorinated water flushed to the receiving environment. If there is any question that damage may be caused by a chlorinated waste discharge (to fish life, plant life, physical installations, or other downstream water uses of any type), then an adequate amount of reducing agent should be applied by the Contractor to water being disposed of to neutralize thoroughly the chlorine residual remaining in the water.
- H. After final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 16 hours apart, shall be collected from the new main, and submitted to NPU for analysis. At least one set of samples shall be collected from every 1,000 feet of the new water main, plus one set from the end of the line and at least one set from each branch. The first sample (or first set of samples) shall be taken immediately following flushing, the second sample (or second set of samples) shall be taken after the new water main has sat idle for at least 16 hours, without any water use and without any flushing. Samples shall show the absence of coliform organisms and the presence of a chlorine residual. If the initial disinfection fails to produce samples that pass CT DPH requirements for potable drinking water, then the new main shall be re-flushed and shall be resampled until satisfactory test results are obtained. The taking of samples from hoses or fire hydrants will not be allowed.
- I. Where connections equal to or less than one pipe length are to be made between new and existing water mains after disinfection and flushing are completed, new materials shall be swabbed with a 15% hypochlorite solution.

4.03 REQUIRED WATER QUALITY TESTS

The Contractor shall arrange for the NPU Testing Laboratory to take samples and test for a Total Coliform and any other additional testing or items required by NPU.

The Contractor shall contact NPU Testing Laboratory to take the required water samples after completion of flushing and disinfection of the water mains. The Contractor shall be responsible for all coordination with the NPU Testing Laboratory. NPU shall bear all costs associated with the initial water quality testing and analysis. The Contractor shall bear all costs of any additional water quality testing and analysis if required due to failed test results.

SECTION 5.0 FINAL ACCEPTANCE

- A. Upon receipt of written notice from the Contractor that his work is complete, NPU will conduct a final inspection and will notify the Contractor of all instances in which the work fails to comply with these specifications as well as any defects that may be discovered. The Contractor shall thereupon rebuild, alter, and restore the work so it will comply with these specifications and remedy any defects at his own cost and expense and to the satisfaction of NPU. Upon completion of such alterations or repairs, NPU will issue their certificate of final acceptance of the work. No water will be furnished to the new main until the certificate of acceptance has been issued.
- B. A FINAL INSPECTION shall be conducted by NPU and include but not be limited to:
 - I. Valves, hydrants, and curb stops operating properly.
 - II. Valve boxes and covers set plumb and at proper elevations.
 - III. Proper hydrant nozzle height above grade.
 - IV. Proper hydrant opening direction, nozzle thread, and barrel color.
 - V. Proper distance from the face of the curb of hydrant nozzles.
 - VI. Hydrant bands and numbers shall be installed on each fire hydrant at the time of installation.
 - VII. Static and residual hydrant pressures and flow rates, if requested.
 - VIII. Curb boxes inside ROW, set to grade, containing stainless steel operating rod, and plumb.
 - IX. Tie information on record drawings complete and correct.
 - X. Material testing results, lab reports, manufacturer's certificates, and leakage test results complete and on file.
 - XI. General appearance and restoration.

SECTION 6.0 BACKFLOW AND CROSS CONNECTIONS

6.01 GENERAL

A cross-connection is an actual or potential connection between a potable water system and any other source or systems, including well water, through which it is possible to introduce into the potable water system any contaminating or polluting agent. Contamination will result when a cross-connection exists and backflow or a reversal of flow occurs. There are two types of backflow: back-siphonage and back-pressure. Back-siphonage results when there is a negative pressure in the system and the contaminant is pulled into the drinking water supply. Backpressure occurs when the pressure on the non-potable system is greater than the potable system and the contaminant is pushed into the drinking water supply.

No plumbing fixtures, devices, or construction shall be installed which may provide a cross connection between the NPU supply and a drainage system, soil or waste pipe, so as to permit or make possible the backflow of sewage or waste into the supply system. Draw-off pipes for draining sprinkler systems shall not be connected into a drainage system or a submerged pit. NPU uses the State of Connecticut, Cross Connection Control Manual, prepared by the State of Connecticut Department of Public Health for cross connection control and backflow prevention.

6.02 REQUIREMENTS FOR BACKFLOW PREVENTION

All commercial and industrial users and fire protection systems shall be equipped with a backflow preventer of a testable type located immediately after (downstream of) the water meter. Backflow preventer applications shall conform to Section 608 Protection of Potable Water Supply of the Connecticut State Building Code and be approved by NPU prior to installation.

High and moderate hazards to the system are to be protected through the installation of a reduced pressure zone (RPZ) type of backflow device assembly. High and moderate hazard uses include, but not limited to the following: metal plating process, hospital, nursing home, clinic, hotel, mortuary, laboratory, film processing, car washing, chemical process or storage, food processing, restaurant, irrigation systems, hair salon, sewage treatment, chemical fire protection, or any commercial building with the ability for occupancy changes.

Low hazards are to be protected by the installation of a double or dual check valve backflow device assembly. Low hazard operations include but are not limited to single-family residential structures. In all cases, backflow prevention shall be installed and be operational prior to connection to NPU's system. Commercial connections shall be equipped with a reduced pressure zone style backflow preventer in order to isolate the public water system prior to service connection. Valves shall be located on both sides of the backflow preventer with drain or test plug on the valve located between the meter and backflow device.

It is required that the Applicant's Professional Engineer review all piping within any proposed development building or industrial facility and identify locations where isolation backflow preventers will be needed to protect the water supply from potential contamination.

All commercial or residential lawn sprinkler systems must be provided with an appropriate pressure backflow device assembly where the system connects to water supply. It shall be in a location that is always free-draining and cannot be submerged.

All permanently connected fire sources and private hydrants shall be equipped with isolation type reduced pressure backflow preventers of a testable type. Backflow prevention may be incorporated into the meter system piping. The device shall be placed in a location that is protected from damage by frost.

SECTION 7.0 METERED SERVICES

7.01 INSTALLATION OF METERS AND METER VAULTS

All new construction will require that a meter be installed at the time that the service connection is made to the main.

The meter and any associated reading devices are the property of NPU and will be furnished and installed without charge to the Customer.

Meters 2" and above shall have a meter bypass. A meter bypass detail is included in Appendix A.

NPU will determine the appropriate size, type and number of meters for each premise based on expected flows as determined by the Engineer. No submetering of a premise will be allowed without NPU approval.

Meter pits or meter vaults, including the meter vault cover, become the property of the Customer upon installation, and the Customer is responsible for maintenance and repair of the meter vaults as needed from time to time. Meter pits or meter vaults should be kept free of debris, which will help prevent the meter from freezing or being otherwise damaged. Meter pits shall be installed with an insulated cover. Refer to Details W-11 and W-12 for typical meter pit installations.

7.02 LOCATION OF METERS

SINGLE FAMILY RESIDENTIAL CONSTRUCTION

NPU shall determine the location of meters; all meters must be installed at the time the service is connected to the main.

The water meter shall be located in the basement or mechanical/utility room if one is available and protected from freezing and other damage

The water meter shall be placed where the water service line comes through the basement wall or basement floor. Where no basement is provided, the meter shall be placed where the service line comes through the wall or floor of the mechanical/ utility room. No water meters may be installed in a crawl space under a residence. A meter pit may be installed outside the residence if the meter cannot be installed in the basement or mechanical/utility room.

All water meters installed within buildings shall be in a horizontal position, a ball valve must be installed between 6-12 inches from where the water service first penetrates the floor or wall of the structure. Refer to Detail W-13 for typical water meter installation.

The base of single water meters shall be set at a height not less than 30 inches, and not more than 42 inches, above the floor surface.

Meters may not be located above the first or ground floor level under any circumstances. The individual water meter servicing a dwelling unit shall be the only water meter located within the interior space of that dwelling.

A minimum of three feet of working clearance around the meter is necessary for routine meter maintenance.

Water Meter Size (in)	Meter Location – Maximum Distance from Wall (including incoming water line and length of meter housing)
5/8	7.5 Inches
1	10.75 Inches

MULTI-FAMILY RESIDENTIAL CONSTRUCTION

For multi-family construction (condominiums), NPU will require each unit to be equipped with separate service lines, meters, and curb valves. NPU will size the service to ensure proper service to each living unit. NPU will allow the following meter installation methods:

Inside Meter Installation. All meters must be installed in a suitable location which will provide adequate protection against freezing or other damage. Each inside meter setting must be located where the service line enters the building in a horizontal position not less than 18" nor more than 36" above the floor.

Outside Meter Installation. All meters installed outside of the premises must be installed in an NPU-approved meter pit. Approved meter pit details are included in Appendix A.

COMMERCIAL CONSTRUCTION

For commercial construction, the following criteria will apply:

- **Inside Meter Installation.** For meters installed inside of the premise, a separate meter room with outside access and key must be provided to NPU. All meters must be installed in a suitable location which will provide adequate protection against freezing or other damage. Each inside meter setting must be located where the service line enters the building in a horizontal position not less than 18" nor more than 36" above the floor.
- **Outside Meter Installation.** All meters installed outside of the premises must be installed in an NPU-approved meter pit.

Industrial Construction: All meters must be installed in a suitable location which will provide adequate protection against freezing or other damage. Each inside meter setting must be located where the service line enters the building in a horizontal position not less than 18" or more than 36" above the floor.

Service Reuse: In the event that an existing service connection and meter is to be reused due to a change in the original use of the property, the Customer must notify NPU for approval. NPU will evaluate the change in use and apply the appropriate metering requirements.

If NPU determines that no suitable inside location can be made available, or if there is no existing structure to provide said suitable location at the time that the service connection to the main is installed, it will require that the meter be installed outside in a Meter Vault, located and built in accordance with NPU's specifications at the Customer's expense.

When a Premises is supplied by a Service Line judged by NPU to be unusually long, over 100 feet, the meter be installed outside in a meter vault or NPU-approved above-ground enclosure, located and built in accordance with NPU's specifications at the Customer's expense.

7.03 DAMAGE TO METERS

The Customer shall be responsible for the meters installed indoors or in a meter pit and shall provide for proper protection of the meter against freezing, damage by hot water, and damage or loss by any other means. The repair of damaged meters shall be done by NPU and the Customer shall assume the costs of such repairs, or if necessary, the replacement of the meter.

7.04 ACCURACY OF METERS

All meters will be tested for accuracy before installation and periodically thereafter in accordance with AWWA Manual M6. No meter will be placed or kept in service unless it registers within the limits of accuracy specified.

Upon written request of a Customer, NPU will test the accuracy of a meter, without charge to the Customer, in use at the Customer's premises provided the meter has not been tested by NPU within one year prior to such request and provided further that the Customer shall agree to abide by the results of such test as the basis for any adjustment of disputed charges. Upon receipt of such request, NPU shall notify the Customer within one week of the request that such Customer or his or her authorized representative may be present at the meter test. NPU will notify the Customer of the results of the test. NPU will supply a written report of the test to the Customer if requested.

The provisions of this Section do not apply to fire service line meters owned by the Customer.

7.05 TAMPERING WITH METERS

Meters shall not be opened, adjusted, removed, have devices attached, or interfered with in any way by the Customer or his Agent.

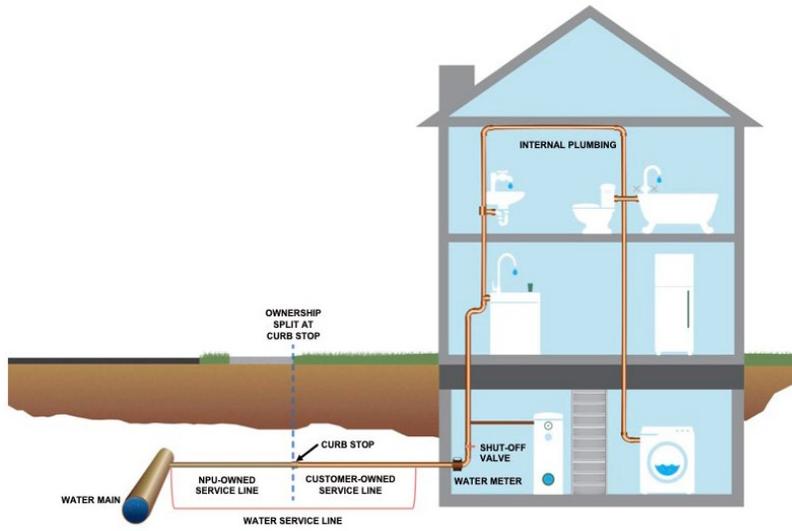
SECTION 8.0 SERVICE LINES

8.01 SERVICE LINES

- A. Service lines on all water mains shall be copper from the corporation to the curb stop. Beyond the curb stop, HDPE CTS is allowed.
- B. Service lines shall be installed to run perpendicular, in a straight line from the water main to the curb stop.
- C. Where fire services are required, there shall be a separate domestic service shutoff and a separate fire service shutoff outside the building being served. Fire services shall be stubbed 3' above the building floor grade.
- D. Each service shall consist of a corporation, curb stop, copper tubing and standard curb box.
- E. Copper tubing shall be type "K", soft temper, conforming to ASTM B88. The name or trademark of the manufacturer and type shall be stamped at regular intervals along the pipe.
- F. Copper service pipe shall be one piece from the corporation to the curb stop.
- G. The minimum service size for a single-family residence shall be one inch (1"). The minimum service size for a duplex shall be one inch (1"). Service lines for single family homes and duplexes with fire sprinkler systems shall be sized appropriately for sprinkler system and domestic demands. Service lines for single family homes with sprinkler systems shall be a minimum of 1".
- H. All underground service line valves, fittings, corporations, curb stops, meter tail setters, elbows, and angle valves shall be manufactured in accordance with AWWA Standard C-800, latest edition, and as further specified in these specifications. All service line components used to convey or dispense water for human consumption shall comply to NSF/ANSI 61 Annex G hereafter referenced as Low-Lead Brass.
- I. Low-Lead brass fittings shall be AY McDonald, Cambridge, or approved equal. All Low-Lead brass fittings shall have the manufacturer's name or trademark integrally stamped or cast on it. Another marking, identifying the "Low-Lead" brass alloy shall also be cast or stamped on the fitting.
- J. Corporations shall have threads per AWWA C800 Table 7 / Figure 2 at the inlet, and a compression type fitting at the outlet, per AWWA C800, Figure 4. Both inlet and outlet shall be the same size. In no instance, except when a tapping sleeve and valve is used, shall a tap be made without a corporation. Corporations shall be AY McDonald, Cambridge Brass Low-Lead, or approved equal. Corporations shall be ball valve type with minimum allowable pressure rating of 300 psi. Corporations shall have dielectric bushings.
- K. Curb stops shall be a ball valve type with a minimum allowable pressure rating of 300 psi and manufactured in accordance with AWWA C800. The curb stop shall open left, have a positive stop, be full port, provide a drip-tight shutoff in the closed position, and be of the tee design or flat design. No curb stop shall have the ability to drain the service line. Both

the inlet and outlet of the curb stop shall have compression type fittings. The tee head of the curb stop shall have the provision for the connection of a service rod. Curb stops shall be AY McDonald, Cambridge Brass Low-Lead, or equal. The curb stop shall rest on a four inch by eight inch by sixteen inch (4" x 8" x 16") solid concrete block for support. Curb stops shall be installed just inside the City right-of-way unless otherwise approved. The distance between finish grade and the top of the stainless-steel service rod shall not exceed four feet (4').

- L. Curb boxes shall be standard type. The base of the box shall be arch type to prevent the box from resting on the curb stop. The adjustable upper section shall be one inch (1") diameter for use with ¾" and 1" curb stops. For larger curb stops, the curb box shall be installed over a heavy foot piece. Stationary rods affixed to the key of the curb stop with a brass pin shall be thirty inches (30") in length for ¾" and 1" curb stops and twenty four inches (24") for large curb stops. Curb box rods shall be stainless steel. The word "WATER" shall be inscribed on the cover of the box. The cover of the box shall have countersunk brass pentagon plug for all locations including paved, concrete, and grass areas. Curb box couplings and extensions will be the same material as the curb box. Both cover and upper section of the box shall be able to be located with a ferrous type metal locator. All boxes shall be plumb, accessible and operational prior to final inspection.
- M. All service connections shall be installed to the curb stop for all building lots before the street is paved.
- N. Service connections shall be made by installing the approved service line from the curb stop/gate valve through the cellar wall or floor. A meter shall be installed after a ball valve or angle valve on the incoming service. The Contractor shall be required to perform all plumbing of the downstream meter connection, including a shut off, appropriate backflow device, and recommended pressure regulator, all installed in accordance with standard plumbing practices. Meters shall be installed horizontally at the point of entry into a building and before any lateral. Meters shall be installed between 12" and 48" from the floor, and 12" from any wall. Reasonable space for access shall be provided around the water meter and valving to allow for maintenance. (See Metered Service Section)
- O. No service connection shall be made on any hydrant branch assembly.
- P. All services shall be of the following standard sizes: ¾", 1", 1-1/2", or 2", as determined by a Licensed Professional Engineer. Non-standard sizes (e.g. 1-1/4") are prohibited.
- Q. Service lines beyond the curb stop may be horizontal directional drilled (HDD) beneath a roadway if required and approved by NPU. The drilling Contractor shall have 5 years local experience in HDD. HDD shall be performed in accordance with the Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of HDPE (PE4710) Pipe in Municipal Applications (MAB-7 2020).
- R. Ownership of service lines is shown below. The portion of the service line from the water main to the curb stop is owned by NPU. The service line from the curb stop to the meter is owned by the property owner. The property owner is responsible for all repairs to the service line from the curb stop to the meter and all interior plumbing.



Service Line Ownership

SECTION 9.0 FIRE SERVICE LINES

9.01 INSTALLATION

Fire service lines, private fire hydrants or fire sprinkler systems will be installed in accordance with all State, City, NPU and other applicable regulations covering service lines and under the direction of the local Fire Marshal. Fire Marshal shall conduct all pressure testing on fire service lines. Refer to Detail W-10 for typical installation.

Meters and Reduced Pressure Devices (RPD)

- a. All sprinkler systems and private fire service lines shall be subject to current CT DPH and NPU regulations concerning cross connections and backflow prevention. An RPD shall be installed on each service that falls under these regulations.
- b. Meters and RPD approved by CT DPH and NPU for private fire service lines shall be furnished by and installed at the expense of the property owner.
- c. Fire meters owned by the Customer will be tested and maintained by the Customer at their expense in accordance with NPU's requirements.
- d. Fire service lines are required to be metered separately.

9.02 ACCESS

NPU representatives shall be granted access to fire meters and alarm systems at all times.

9.03 USE

No person shall take water from any private fire hydrant, hose plug, sprinkler system, or fire service line except for testing or in case of fire. In the event NPU finds that a customer is taking water from a private fire hydrant, hose plug, sprinkler system, or fire service line for any purpose other than for testing or in the case of a fire, the customer will be assessed a Theft of Service Charge as approved by PURA and listed in NPU's miscellaneous charges.

9.04 ABANDONMENT

The customer shall provide NPU with approval from the local fire marshal and a letter from their insurance carrier acknowledging that the fire service is being abandoned or disconnected before a customer's request for discontinuance of a private fire service can be processed by NPU. The customer is responsible for billings until terminated.

9.05 ANTI-FREEZE SOLUTIONS

For sprinkler systems supplied with water by NPU, the use of antifreeze solutions other than water solutions of pure glycerin (C.P. or U.S.P. 96.5% Grade) or propylene glycol (U.S.P. Grade) is prohibited. The use of antifreeze solutions must conform to any applicable State or local health regulations.

LIST OF DETAILS

W-1	Standard Water Main Trench Detail
W-2	Vertical Gate Valve and Gate Box
W-3	Fire Hydrant Assembly
W-4	Water-Manual Air Release
W-5	Water Service Connection
W-6	1" Flushing Assembly
W-7	Thrust Block Detail
W-8	Sleeving Detail
W-9	Concrete Encasement Detail
W-10	Sprinkler/Fire Service Detail
W-11	2" Meter Pit Detail
W-12	5/8" Meter Pit Detail
W-13	Water Service Detail
W-14	Meter Bypass Detail