CITY OF ASHEVILLE WATER RESOURCES
DESIGN & CONSTRUCTION MANUAL

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W1 GENERAL

A. Intent
The Water Distribution Design and Construction Manual establishes the minimum standard for providing, extending, upgrading, replacing and maintaining the public water distribution system owned, operated and maintained by the City of Asheville.

B. Scope
The guidelines contained within this section are aimed at providing the general public and design community the minimum standards and procedural requirements required to design construct and convey new extensions, replacements or upgrades to the public water distribution system.

C. Specific Terminology
As used in this Manual, unless the context shall otherwise require, the words and phrases in this paragraph shall have the meanings herein defined:

1. Delegated Authority: The authority designated by the Public Water Supply Section of the North Carolina Department of Environment and Natural Resources pursuant to 15A NCAC 18C.0300 to approve plans for construction of extensions and modifications of the Water Distribution System. As of the date of adoption of this Manual, the delegated authority is the City of Asheville Water Resources Department.

2. Developer: The person, corporation, partnership, or other legal entity who has overall responsibility for the extension or modification of the Water Distribution System for the purpose of extending water to new property for development.

3. Director: The Director of the Water Resources Department of the City of Asheville.

4. Engineering Division: The Engineering Division of the Water Resources Department of the City of Asheville; hereafter, Engineering Division.

5. Extensions: The addition of Water Distribution System facilities for the purpose of providing accessibility of water and/or fire service to additional property or upgrading the capacity of water and/or fire service to property already accessible for service.

6. Fire Department: The specific regularly organized fire department, fire protection district, or fire company regularly charged with the responsibility of providing fire protection to the jurisdiction within which the specific area being served by the specific extension or modification to the Water Distribution System is in question.

7. Fire Official: The officer or other designated authority, or his/her duly authorized representative charged with the administration and enforcement of the Fire Prevention Code, of the Fire Department.

8. Inspector: A construction inspector employed by the Water Resources Engineering Division and assigned to make periodic observations of water distribution system construction and to witness testing and disinfecting processes.

9. Modifications: The replacement of Water Distribution System facilities adjacent to property already accessible to water service to improve reliability of service, reduce repair frequency and cost, reduce leakage, increase residual pressure, or otherwise update or increase the assets of the facilities for such service.

10. Repair: Work performed on the Water Distribution System to remedy a break, defect, or leak and restore water service to conditions which preceded the occurrence of the defect.

11. Service Line: The tap on a water main and extension of pipes from a tap to a water meter (or two water meters in the case of a split connection, to include the meter box, meter stop valve, meter yoke, water meter, meter by-pass, dual check valve, and other pipe accessories, for the purpose of providing service to a single property (the service line on a split connection may serve two meters, each serving a separate property, with these two properties adjacent to each other).

12. Technical Specifications: The City of Asheville Standard Technical Specifications for Construction of the Extensions or Modifications to the Water Distribution System, adopted separately from this Manual, which govern the detailed specifications for contracted construction of water facilities to meet these design standards.

13. Water Distribution System: All real and personal property owned, or to be conveyed for Ownership, to the City of Asheville as facilities for the conveyance, transmission, or distribution of treated drinking water which is operated and maintained by the City of Asheville Water Resources Department, under the Water Policies.

14. Water Policies: The most recently adopted City of Asheville Water Resources Department Policies.

15. Water Resources Department: The Water Resources Department of the City of Asheville.

16. Reference Material: Where not specified in this Manual, Water Department Policies, technical specifications, city ordinances or the North Carolina Administrative Code Title 15A, Subchapter 18C, to protect the public health, safety and welfare, the Director of Water Resources Department will specify the standards to be applied to the design and construction of public water system improvements and may refer to other industry standards and references not listed herein.

W2 PROCEDURES FOR EXTENDING WATER SYSTEM AND OBTAINING SERVICE:

All proposed and authorized new extensions or modifications to the Water Distribution System shall conform to this Water Design and Construction Manual and be constructed in accordance with the Technical Specifications and Standard Details.

The following provides an outline and general information of the process for extending the Water System to provide water service to one or more new properties.

Updated copies of necessary submittal forms and requirements are available on the City of Asheville website www.ashevillenc.gov, Water Resources Department. Any questions concerning the process or requirements should be addressed to Water Engineering Division at (828) 259-5617.

Stage I. Water Availability / Letter of Commitment Application:

Submittal of application, any applicable fee and sketch plan to the Water Resources Department Engineering Division (Telephone No. 828-259-5955). Water Resources Department reviews applications and issues or denies Letter of Commitment through Director based on application of Water Policies.

A. Letters of Commitment are required:

1. Whenever more than 4 meters are desired at a single location.
2. For new subdivisions with more than 4 lots or whenever an extension of the water system is required to serve the subdivision.
3. Whenever a single meter larger than 1-inch is required.
4. Whenever the required water service involves a fireline connection and domestic water service of any size.

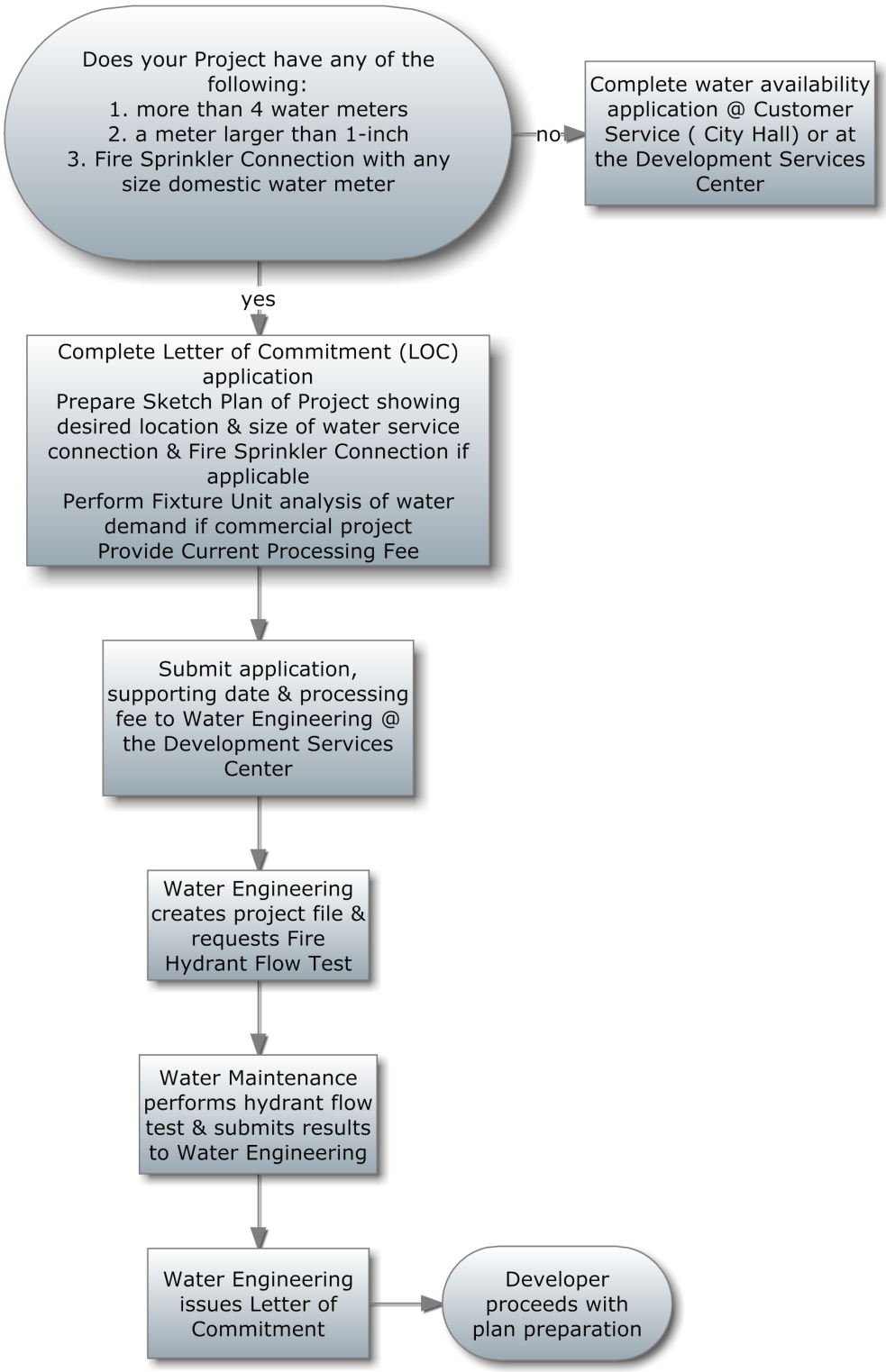


Figure W02-a: WATER AVAILABILITY/ LETTER OF COMMITMENT PROCESS

B. For commercial projects, a fixture unit analysis of the peak domestic water demand shall be provided with the application, see the provided resources in Figures W03-b through d below. The sketch plan shall indicate whether or not the project includes a fire sprinkler connection.

Figure W02-b: DEMAND WEIGHT OF FIXTURES IN FIXTURE UNIT

Fixture type	Weight in fixture units
Bathtub	4
Bedpan washer	10
Bidet	4
Dental unit or cuspidor	1
Dental laboratory	2
Drinking fountain	2
Kitchen sink	4
Laboratory	2
Laundry tray (1 or 2 compartments)	4
Shower, each head	4
Sink: service	4
Urinal, pedestal	10
Urinal (wall lip)	5
Urinal stall	5
Urinal with flush tank	3
Urinal trough (for every 2 foot section)	2
Wash sink, circular or multiple (each set of faucets)	2
Water closet: F.V.	10
Water closet: tank	5

Figure W02-c: EXAMPLE – FIXTURE UNITS AND ESTIMATED DEMANDS

Kind of Fixtures	Building Supply		
	No. of Fixtures	Fixture Units	Demand (gallons per minute)
Water closets	130	1,300	
Urinals	30	150	
Shower heads	12	48	
Laboratories	130	260	
Service sinks	27	81	
TOTAL		1,839	310

Source: "Rules Governing Public Water Systems", Title 15A, Subchapter 18C of the North Carolina Administrative Codes, NCDENR-Division of Environmental Health, Public Water Supply Section

Figure W02-d: ESTIMATE CURVES FOR DEMAND LOAD

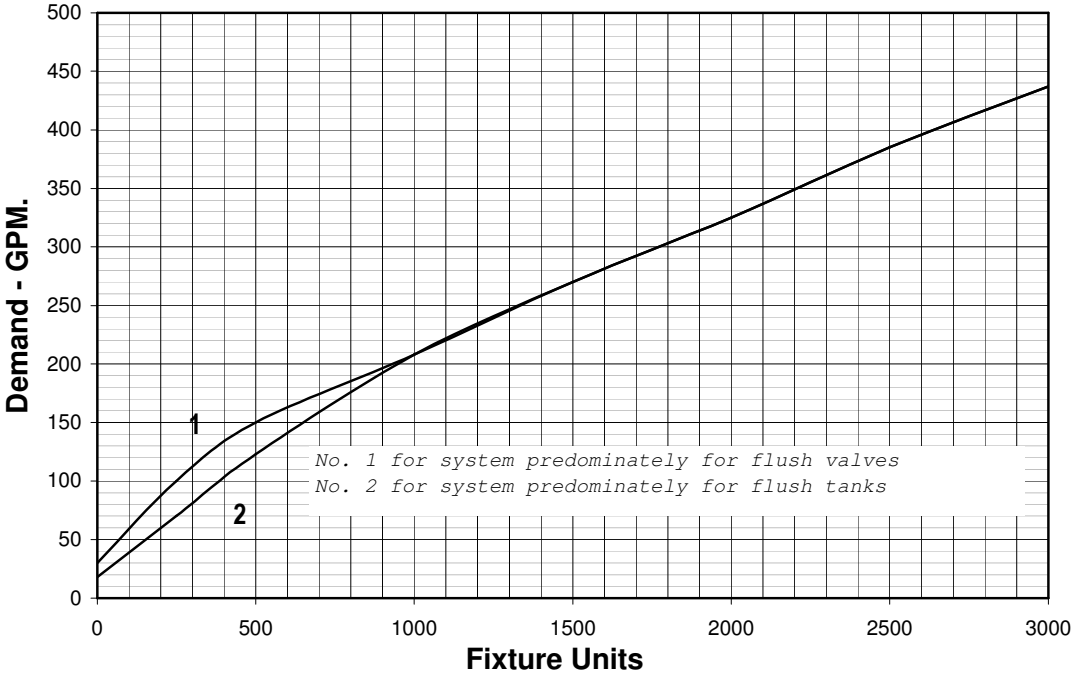
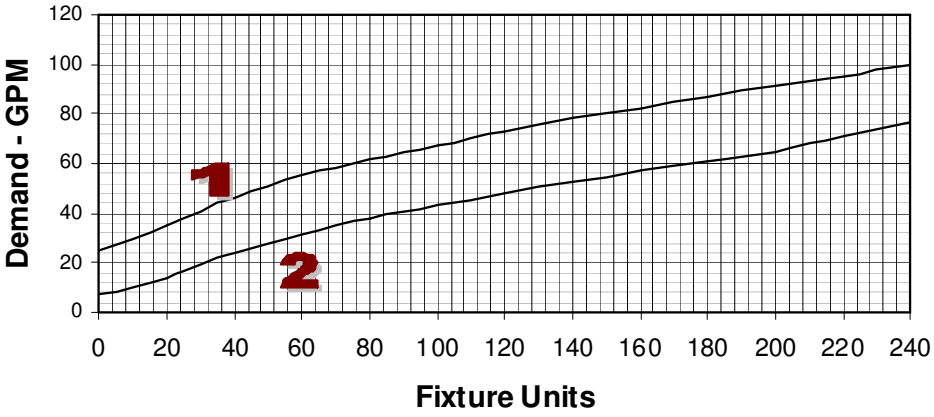


Figure W02-e: ENLARGED SCALE DEMAND LOAD



Source: "Rules Governing Public Water Systems", Title 15A, Subchapter 18C of the North Carolina Administrative Codes, NCDENR-Division of Environmental Health, Public Water Supply Section

Stage II. Plans and Specifications Submittal and Review:

A. Plan Review Submittals:

1. General: All water main extensions shall be authorized by a valid Letter of Commitment before the Water Engineering Division will accept engineering plans for review and approval. Proposed connections to a dedicated fire-line do not require a Letter of Commitment but do require plan review and approval by the Water Engineering Division.

   Submittal of 2 sets of plans, Addendum to Engineer's Report, Application for Approval, Data Sheets and Hydraulic Calculations and to the Engineering Division of the Water Resources Department with the required fee. Fire Sprinkler Plans will be required for all fire protection service extensions.

2. Plan Requirements: All new extensions or modifications to the Water Distribution System, except for service lines installed by the Water Resources Department, shall be provided on engineering plans conforming to this Manual, sealed by a Registered Professional Engineer, and approved by the Water Resources Department, and by the Delegated Authority of the North Carolina Department of Environment and Natural Resources, if different from the Water Resources Department. Design shall further conform to all other applicable federal, state, and local laws and regulations, and all required permits shall be obtained prior to construction.

   Plans shall consist of legible prints, shall not be greater than 24" X 36" in size, and to a scale no smaller than ***1" = 50'***. Engineering plans shall clearly show and label the proposed waterline extension, all fittings and appurtenances, including restrained joint lengths, service lines and water meter locations to be installed; existing and/or proposed roads and road right-of-way; waterline easements; lot lines; lot numbers; proposed location of all new underground utilities within the same right-of-way as the proposed water system improvements; topographic information, profile view to include proposed final depth of bury of water mains and facilities, and conflicts or crossings with other underground utilities; north arrow; location map; applicable and current City of Asheville Water Engineering Standard Details; and any other information necessary for the appropriate and accurate construction of the proposed water system extension or modification.

3. Addendum to Engineer's Report, Application for Approval, Data Sheets and Calculations: In accordance with NCAC Title 15A, Subchapter 16C, Section .0300 the engineer of record must, at a minimum, submit an "Addendum to Engineer's Report" for every waterline extension project. The format of said report shall meet the outline presented in Section .0307 of NCAC Title 15A. A sample version is available on the City of Asheville Water Department's web page.

   An Application for Approval is also required for every waterline extension project. Also the appropriate data sheets must be submitted with the Application for Approvals. The most current version of the Application for Approval and data sheets

are available on the City of Asheville Water Department's web page is available for download and completion.

Hydraulic Calculations must be submitted for every waterline extension project. The calculations shall be based on the hydraulic flow test information obtained in the Water Availability / Letter of Commitment process. The hydraulic calculations, at a minimum, must indicate the residual pressure of the proposed system at the most hydraulically deficient point for both peak domestic flow and fire flow conditions. If deemed required additional calculations or system models may be required to demonstrate adequate system pressures and flows.

4. Design Report: Submittal for those projects including a booster pump station and storage tank must also contain a separate "Design Report" with the following minimum information:

   a. Water Mains and Related Appurtenances:
   - i. Number people or homes to be served.
   - ii. Required Fire Flow calculated as required by this Manual and by the Fire Official.
   - iii. Maximum instantaneous flow as provided in Letter of Commitment.
   - iv. Total consumption in gallons per day as provided in Letter of Commitment.
   - v. Hydraulic analysis of the proposed extension to the water system, using average day conditions at the point of connection provided by the Water Resources Department, confirming minimum residual pressures are satisfied under maximum instantaneous demand with minimum 40 PSI residual at highest point and average day demand plus maximum fire flow demand with minimum 20 PSI residual at highest point.

   b. Water Booster Pump Stations and Reservoirs:
   - i. Pump Data: Rated Design Capacity (GPM) and Total Dynamic Head, Pump Curve, System Curve, and all Supporting Calculations, Motor Nominal Horsepower and System Power Efficiency at Design Point
   - ii. Reservoir Data Basic dimensions - shape, diameter, height (structure and water level), Overflow elevation, Water capacity, Structural design calculations confirming compliance with AWWA Standard D100 or D110, as appropriate
   - iii. Controls, Planning and Instrument Diagram, Proposed Automatic Control Set Points, SCADA Point Count

   c. Service Line Connections:
   - i. Number and size of domestic connections, peak water use of each, customer type (residential, institutional, commercial, etc.), degree of hazard and proposed backflow assembly.
   - ii. Number and size of fire line connections, dedicated or in-line, dry or wet system, use of fire suppression chemicals, booster pumping (include pump data), water volume and pressure expected at point of connection to water system, and type of metering, backflow prevention, and/or water use detection devices proposed.

5. Other Submittals and Permit Approvals: As required by specific project; the following list is intended as a guide to the applicant but may not be complete for all types of construction. The Developer's engineer shall be responsible for insuring all required permits are obtained prior to construction.

   a. City of Asheville or NCDENR Sediment and Erosion Control Permits.
   b. U S Army Corps of Engineers - Water, Stream and River Crossings.
   c. Federal Emergency Management Agency - Designated Flood Plain Construction.
   d. Railway Encroachments or Easements.
   e. North Carolina Department of Transportation Encroachments.
   f. City of Asheville Street Cut Permit and/or Encroachments.
   g. Utility Easements - Obtained for Water Extensions.
   h. Pertinent Fire Marshal Office - Fire Flow and Fire Hydrant Location Approval

B. Review Process

1. Water Engineering Division's review and comments to the Developer or his/her engineer.
2. Submittal of revised plans to the Water Engineering Division with changes required by review comments in addition to the required Estoppel Certificate, when applicable.
3. Water Engineering Division's final review and approval or rejection of plans. If the Water Resources Department is not the Delegated Authority for plans proposed, the Water Engineering Division will forward plans approved by the Department to NCDENR.

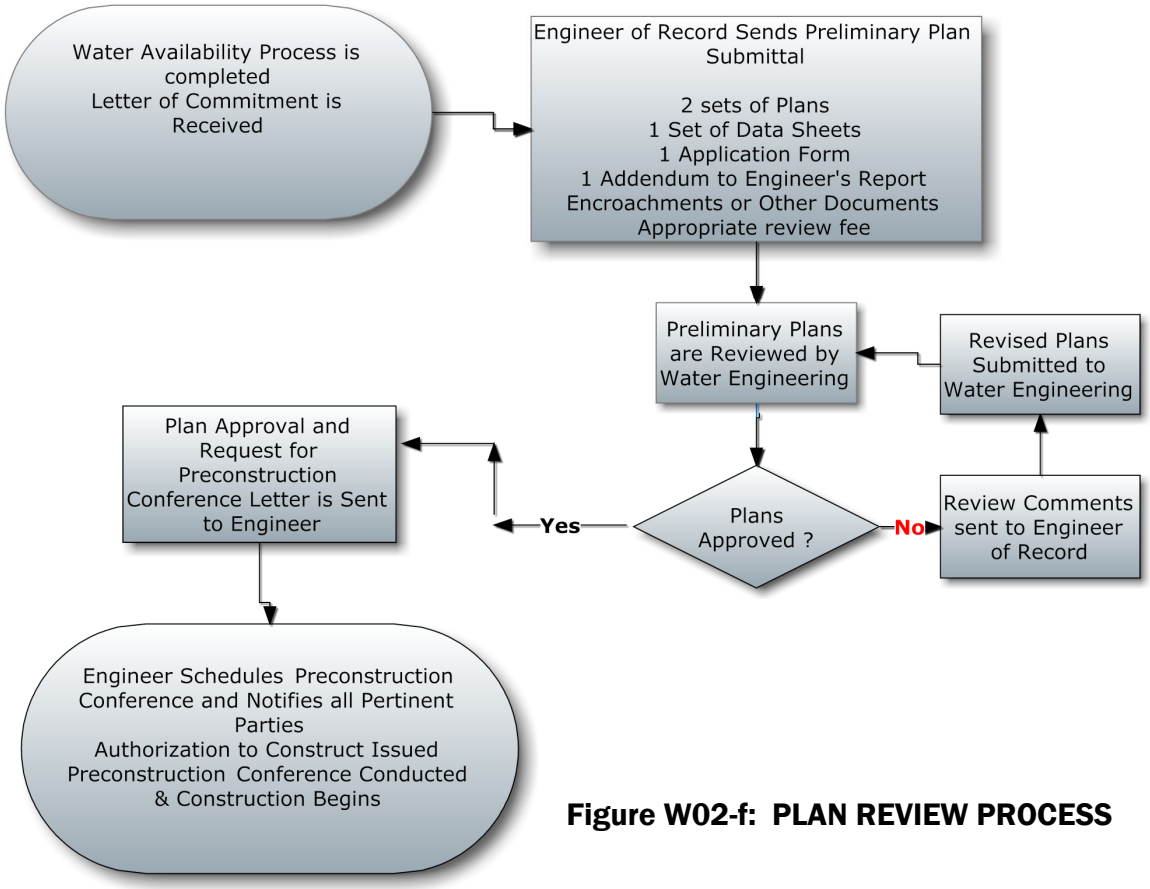


Figure W02-f: PLAN REVIEW PROCESS

Stage III. Construction Phase

A. Construction Process

1. Pre-Construction Meeting and Authorization to Construct: A pre-construction meeting is scheduled by the Water Engineering Division and held with the utility contractor, owner/developer, and engineer of record where construction is discussed and documentation is received confirming required permits, easement, and encroachments. Payment of fees for taps and flow tests are required before construction is allowed to begin. Authorization to Construct is issued at the pre-construction meeting. The pre-construction meeting shall be conducted within 10 days of the start of waterline construction.

   No construction of extensions or modifications shall begin before plans are approved for construction and ***Authorization to Construct*** is granted by the Water Engineering Division through the Pre-Construction Meeting. Any construction done prior to this Notice may be summarily rejected or refused without further investigation. In addition, beginning construction without authorization may violate State regulations and subject the offender to State enforcement actions.

2. Contractor submits material list sheets / shop drawings for review by Water Engineering Inspector. If necessary, the inspector will provide comment and correction for the material list sheets / shop drawings. Once the contractor submittals are approved, construction may begin.

3. Contractor constructs work per the conditions of the approved plans and project specifications, under the observation of the Water Engineering Division's construction inspector and other agencies as required.

4. Pressure testing and disinfection of the new water system is performed. The pressure test and disinfection of new water systems is coordinated and observed by Water Engineering Division's construction inspector.

B. General Information for Construction Phase

1. Contractor License Requirement: All contractors and subcontractors performing any construction on water distribution system extensions or modifications, except Personnel of the Water Resources Department, shall be licensed Utility Contractors by the State of North Carolina. The developer shall provide the Water Engineering Division with the names and license number(s) of each contractor or subcontractor before each begins construction on the water system, and on site as requested by Water Department staff.

2. Accessibility During Construction: The construction site shall be accessible at all times from the Authorization to Construct for inspection of progress by the Engineering Division of the Water Resources Department. Failure to provide accessibility may result in rejection of the work.

3. North Carolina Damage Prevention Act Compliance During Construction; Upon the initiation of construction of water system extensions or modifications, but prior to the issuance of a Letter of Acceptance, all locations of the constructed but not accepted water system, required for underground damage prevention by North Carolina law, shall be the responsibility of the developer or his contractor. The Water Resources Department will notify the developer or his contractor of notice of proposed excavation received from other but will accept no further responsibility.

5. Field Changes and Modifications: Any significant revision or modification necessary to take place after plan approval has been granted must be approved by the Water Resources Department. The engineer of record shall submit the necessary documentation to demonstrate his/her concurrence with the revision.

   The Contractor is to keep the City of Asheville-approved set of plans on the job site at all times and further, all as-built changes are to be documented on this set of plans as they occur. Additionally, the Engineer is to be notified of minor changes even when a revision or addendum drawing is not required. After City approval of a field changes, the Water Engineering Inspector will verify that the project Engineer has been notified of the change. All changes are to be incorporated into the final as-built and plat submitted.

   On any project where lot lines are revised to add/delete lots yielding excess and/or non-compliant water meter taps, the contractor shall be required to plug the service tap at the main, remove the corporation stop, service line, meter box and meter setters as necessary. In cases where 2 or more service taps, located within 5 feet of each other, are to be removed, the contractor shall be required to remove said taps by cutting the pipe and installing a mechanical joint sleeve. In situations such as this, the disinfection procedure could be required to be repeated, or some other form of additional disinfecting measure shall be undertaken as directed by the Water Resources Department.

C. Connections to Existing Water System

All connections to the existing Water Distribution System shall be approved by the Water Resources Department Water Maintenance Division. Connections include tapping of existing active water mains or cutting a fitting into an existing water main. Tapping may be permitted when the new branch main is equal to or smaller in size than the existing main being connected to, and there are no valves required on the existing main as a result of the connection pursuant to the VALVES, Location section of this Manual.

***Notice*: Tapping of an active water main by unauthorized personnel, or cutting of a water main on the active part of the water distribution system without the observation of the City, shall constitute tampering of the water system and shall subject the violator to fines and penalties set by the City of Asheville. Further, such actions may cause serious injury to the public health, and are subject to criminal prosecution either by the City of Asheville, the Water Resources Department, or the State of North Carolina.**

1. Tapping: The contractor shall perform all excavation and backfill, through trenching and shoring practices which at all times meet the requirements of OSHA, and shall provide all safety barricading, traffic control devices, and other protection of the excavation. The contractor shall expose the water main to be tapped, and clean all dirt and debris around the main. The contractor shall furnish and install the tapping sleeve and tapping valve meeting this Manual and the Technical Specifications and test the tapping sleeve with compressed air to ensure it is properly installed on the water main. Sleeve testing shall be performed in the presence of a Water Engineering Inspector. The pressure test Sleeve and Valve Assembly shall be pressure tested at 30 PSI air pressure for no less than 20 minutes.

   Only authorized personnel of the Water Maintenance Division are permitted to make the physical tap on an active water main, using the tapping machine furnished by the Division. The Water Maintenance Division shall make the tap by installing its tapping machine on the tapping sleeve and valve furnished by the contractor.

   Through communication with the Inspector, the Contractor shall provide a minimum of 3 business days advance notice to the Water Maintenance Division to request a tap; the Contractor is strongly encouraged to provide additional notice when possible. The Water Maintenance Division must consider its other scheduled obligations and the consequence of service interruptions to customers affected, and has the right to approve or disapprove the Contractor's request. All requests of less than 3 business days, except emergency repairs, shall be denied.

   Service taps on existing active waterlines shall be made by the City of Asheville Water Resources Department. Service taps to new waterlines shall be made by the Contractor in conjunction with an approved water main extension project. Taps made by the Contractor may be made by wet tap or dry tap. Wet taps shall be made after the new water system is pressurized but before the new water main is hydrostatically tested and disinfected and connected to the active water system.

2. Cutting in a Fitting: The contractor shall perform all excavation and backfill, through trenching and shoring practices which at all times meet the requirements of OSHA, and shall provide all safety barricading, traffic control devices, and other protection of the excavation. The contractor shall expose the water main to be cut, and clean all dirt and debris around the main.

   Only authorized personnel of the Water Maintenance Division shall close the valves on the active water system necessary to relieve the pressure and allow the water main to be cut. All others wishing to operate valves shall be specifically authorized in writing by the Water Resources Department. All water shut downs are to be scheduled through Water Engineering Inspectors 4 business days in advance.

   The contractor shall cut the active water main and install the required fitting for connection, only under the direct and continuous observation of the Inspector. The contractor shall maintain on site, at all times during the work, clean cloths dipped in

HTH solution of chlorinated water (approximately 200 PPM chlorine solution) and shall use these cloths to swab all equipment, pipe and appurtenances coming in contact with the interior of the water main, and shall keep the interior of the water main clean and free of debris throughout construction. Contractor must also have a dewatering pump available at all times during this work.

D. Inspection, Testing and Disinfection

All materials used must have a preliminary inspection by the Water Engineering Division Inspector before they shall be allowed to be installed. Materials rejected by the Inspector shall be immediately removed from the job site.

During construction, testing and disinfection the City's public water system shall be protected at all times with the use of an approved construction backflow assembly, also called a construction jumper, installed at the point of connection to the public system. The construction jumper must remain in place until all testing and disinfection is complete and the removal of the jumper is approved by the Water Engineering inspector. If the construction jumper must be removed prior to completion of all testing and disinfection of the water system, an air gap must be provided at the point of connection to the public water system and the water main must be capped and sealed at both ends of the air gap.

Testing and disinfection is done in accordance with the Technical Specifications, scheduled with Water Engineering Division, and witnessed continuously during performance until approved by City as follows:

The Contractor shall furnish all materials, labor, and equipment to perform all testing, disinfection and inspections to the satisfaction of the Inspector. The City of Asheville shall provide water for testing purposes on water mains. Water for the initial hydrostatic test and initial disinfecting shall be free of charge, however, water for subsequent repeat testing due to test failure by the Contractor may result in charges under the Water Resources Department's residential water rate for additional water use.

1. Hydrostatic Testing: Water system testing shall be conducted in accordance with the Technical Specifications for Testing Pipelines.

   All Hydrostatic testing shall be witnessed by the Water Engineering Division Inspector during the full two-hour duration.

   All new water service connections, from taps on the main up to and including meter yokes, meter setters and spool piece for meters in vaults, shall be installed and included in the hydrostatic testing and disinfection processes.

   There shall be no physical connection between the existing water system and a new water main until such time as the new waterline extension is pressure tested, disinfected and a passing clear water sample obtained, and until all closing requirements are fulfilled in accordance with this Manual.

2. Disinfecting: Disinfection of completed lines shall be conducted in accordance with the Technical Specification for Disinfecting Pipelines.

   The maximum total length of water main which may be disinfected at one time is 3,000 linear feet.

   A passing bacteriological is valid for 30 days after the sample was collected. If more than 30 days pass before final acceptance of the water system is issued a new water sample must be conducted and appropriate fees for re-tests must be paid.

   All new service connections installed on water main extensions shall be tapped on the new water main before the water main is hydrostatically (pressure) tested and disinfected, and the service connections shall be thoroughly disinfected up to the meter cut-off valve as the water main is being disinfected. If a contractor taps a water main for any purpose after the disinfecting test but before the Letter of Acceptance, the disinfecting test shall become invalid and will be required to be repeated.

3. Testing and Certification of Backflow Assembly: All backflow assemblies installed as part of a waterline extension must be tested and certified for proper installation and operation. The testing procedure shall be performed in accordance with the City's Cross Connection Control Policy. The test is conducted by a Certified Backflow Tester and is to be coordinator by the Developer or his/her representative.

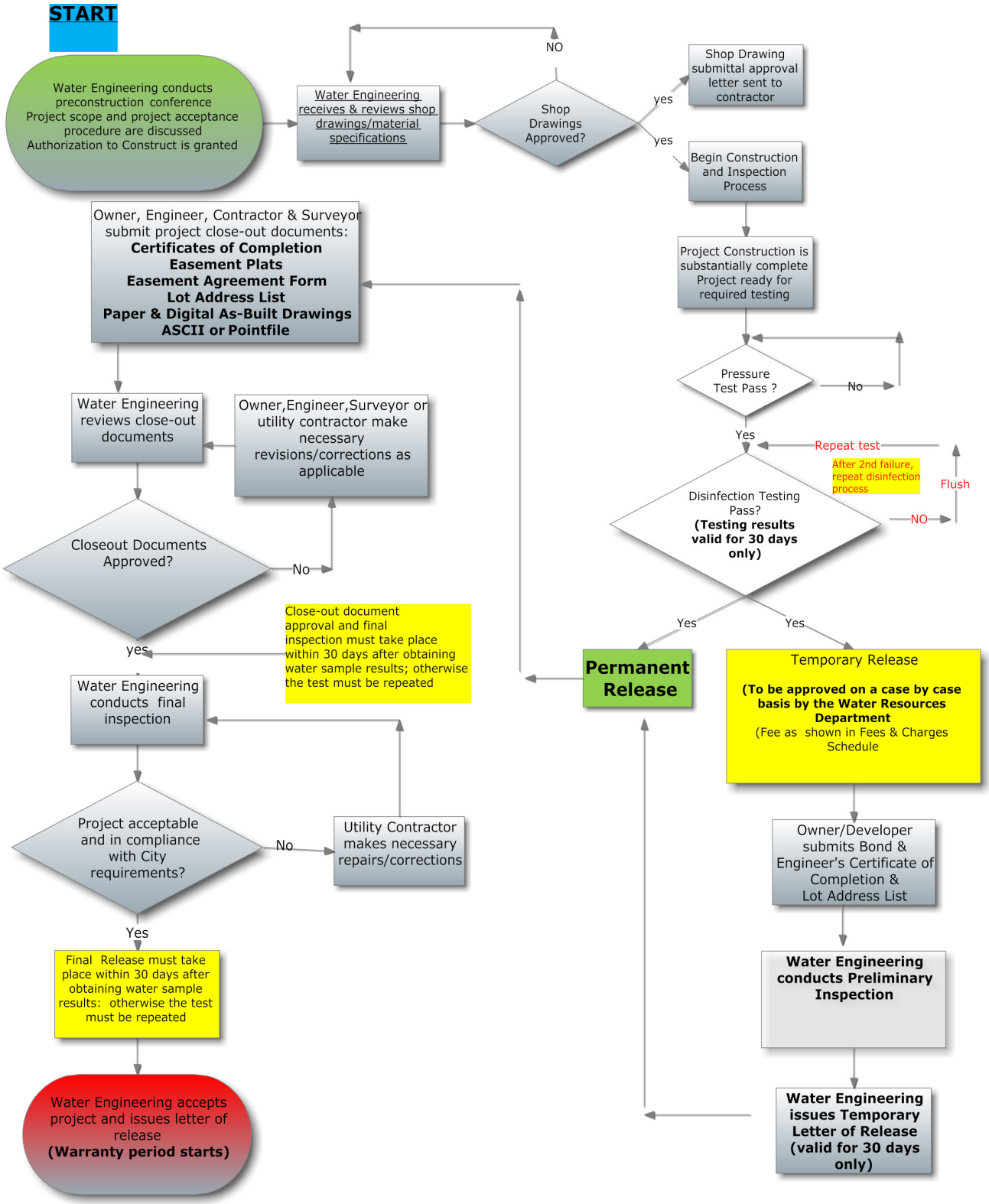
   Until the new backflow assembly has been tested and certified as operational, the construction jumper or air gap must remain in place at the point of connection to the public water system.

Stage IV. Close-out Submittals required for the Acceptance of Waterline Extensions:

The following list of close out submittals is to be used as a guide in the water release process. Depending on specific project some of these submittals may not be required or additional submittals may be required. The exact close-out submittals which are required for a specific project are discussed in detail at the project mandatory pre-construction meeting.

A. Certification of Completion Statements
Developer, Engineer of Record and Contractor of Record must submit certificate of completion statements. These statements are provided at the mandatory preconstruction conference and are available on the City of Asheville Water Department's web page.

Figure W02-g: PROJECT CONSTRUCTION & ACCEPTANCE PROCESS



B. Waterline Easement Plat

In accordance with the requirements outlined in the Right-of-Way, Easements and Access section under WATER MAINS, the developer shall grant the City a 20-foot waterline easement area on all water system extensions constructed outside the limits of public right-of-ways. All waterline easements shall be platted, and said plats shall be prepared by a North Carolina registered professional land surveyor in accordance with N.C.G.S. 47-30 meeting the minimum surveying standards as dictated by the North Carolina Board of Examiners for Engineers and Surveyors. The plat shall, at a minimum, depict the approximate location of the new waterline extension, the limits of the easement area, public/private streets/roads and right-of-ways, building structures and any other feature as may be appropriate. The surveyor shall include all pertinent information necessary to be able to easily recreate the easement area in the field, including as many ties to NC State Plan Coordinate System as necessary. Minimum requirements for the waterline easement plat shall also include the items listed in the **General Guidelines for Waterline Easement Boundary Plats Checklist,** available on the City of Asheville Water Department's web page.

The surveyor shall provide a preliminary easement plat to the Water Engineering Inspector, for field verification prior to recording. Once the plat is field verified, the Inspector will instruct the surveyor to proceed with recordation.

C. Waterline Easement Document

For projects requiring an easement and recordation of a plat an easement document must also be executed, which dedicates the easement area as depicted on the plat to be dedicated to the City of Asheville. The standard form easement document is provided to the Developer at the mandatory preconstruction conference. After completion of the easement form by the developer, the easement documents are to be submitted to the Water Resources Department for signatures along with the applicable recording fee to according to Buncombe County Register of Deeds. Henderson County easements are to be picked up from Water Resources for recordation by the owner/developer or his/her representative.

D. Other Conveyances

Recording of all easements, plats and documents required for operation and maintenance of completed water extensions. Separate deeds are required for additional property easements, and when conveying real property to the City of Asheville.

E. As-built/Record Drawings

The Engineer of record shall provide the Water Engineering Inspector with a paper copy of the as-built drawings for field verification, upon completion of construction of the Water Distribution System extension or modification, and prior to the final inspection. Upon field verification, the inspector will communicate any necessary revisions or instruct the engineer of record to prepare the final paper as-built drawing, the electronic as-built drawing and coordinate file.

The record drawings shall include all water distribution system facilities constructed, including pipes by size, bends and other fittings, valves, hydrants, taps, service lines and meter boxes, pump stations, reservoirs, and waterline easement area(s) to be conveyed to the City, properly depicted using universal drawing symbols on the drawings which correspond to installation locations. Minimum requirements for the record drawings and other as-built documents shall also include the items listed in the **General Guidelines for Waterline AS-built Checklist**, available on the City of Asheville Water Department's web page.

F. Electronic As-built/Record Drawings
The Engineer of record shall submit 1 copy of the digital electronic file in AUTOCAD.DWG format; (the latest release of AutoCAD, which is utilized by the City will be required); on a CD to the Water Resources Department upon completion of construction of the Water Distribution System extension or modification, and prior to the Letter of Acceptance. The electronic as-built shall have the installed waterline(s) and all water appurtenances in a separate isolatable layer along with the pertinent NC grid coordinate data. All property line(s) and right-of-way(s) information shall be in a separate "isolatable" layer.

G. Coordinate File:
Coordinate values (Northing, Easting) and MSL datum elevations for all installed waterline appurtenances shall be delivered in a comma delimited ASCII file in the format Point Number, Northing, Easting, Elevation, and Description. Coordinates shall be based on North Carolina State Plane Coordinate System, Feet as Units of Measure, NAD 83' Horizontal Datum and NAVD 88' Vertical Datum.

The drawings shall reference which Datum is used and the units of measurement. The surveyor has the option to provide this file as a '.txt' or '.xls' file with the same format as mentioned above.

H. Sprinkler System Certification
Sprinkler System Certification form(s) shall be required for all fire sprinkler system connections that have a backflow prevention device other than a reduced pressure zone backflow prevention assembly. The Sprinkler System Certification is provided to the Developer at the mandatory preconstruction conference for completion. The form requires certification from the sprinkler system designer that the sprinkler system does not have chemicals, pumps or other attributes that would classify the system as high hazard for a backflow condition.

I. Official list of assigned addresses
Developer obtains and submits official list of lot numbers and 911 addresses as assigned by the office of the address coordinator having jurisdiction for the project. The official list shall be on the letterhead of the appropriate address coordinator.

J. Backflow Assembly Certification
For all water system extension that require a backflow prevention assembly to protect the public water system; testing and certification of the backflow assembly must be completed prior to the acceptance and activation of the water system extension. A backflow assembly certification must be submitted to the Water Resources Department to indicate that the testing of the assembly has been completed and the assembly is properly installed and functioning.

K. NCDENR approvals
The final approvals and acceptance of the water extension from the State Office of NCDENR must be submitted prior to final release and acceptance by the City in those cases where the State Office of NCDENR plan approval and authorization to construct were required.

Stage V. Final Inspection and Project Acceptance:

A. Final Inspection
A Final inspection is scheduled and facilitated by Water Engineering Inspector. Prior to the final walk-through, all required close-out documents must be submitted and approved by the Water Resources Department. During the final inspection it will be verified that all requirements have successfully been met. If necessary the construction inspector will prepare a punch list of items to be corrected by the contractor. After notified by the contractor that the corrections are made, the inspector will re-visit the site to verify completion.

B. Acceptance of Water Service

A written Letter of Acceptance shall be issued by the Water Resources Department before water meters will be installed and water services can be permanently activated to properties served from the new water system extension or modification. All closeout requirements shall be completed before the Water Engineering Division prepares the Letter of Acceptance.

In cases where minor construction work not affecting operation of the system and/or closeout documents remain to be completed, a Temporary Letter of Acceptance may be obtained. A Temporary Letter of Release may be granted, provided the following requirements are fully met:

1) Payment of temporary meter release fees under the current Water Fees and Charges Schedule;
2) Conveyance of a letter of credit, in the amount of 150%, minimum of $3,500 of the estimated value of the remaining work, including the costs associated with preparation and execution of all pending close-out documents as a guarantee that the work will be completed;
3) Completion and approval of testing, disinfecting, and inspection, including a preliminary final walk-through;

4) Submission of the Engineer's Certificate and the Official list of addresses for the desired meters.
5) Submission of the Backflow Assembly Certification if required for specific project.

Other temporary water service may be provided for provisional use from a fire hydrant installed as part of a new water extension (or improvement) in accordance with the Water Policies regarding temporary service through fire hydrants, provided that completion and approval of all Testing, Inspection and Disinfecting has been achieved.

Stage VI. One Year Warranty Period, Inspection and Repair of New Lines:

A. Contractor's Warranty

The Contractor responsible for the construction of the Water Distribution System extension or modification shall provide the Water Resources Department a written warranty, valid for one year from the date of the Letter of Acceptance, against any and all defects due to faulty materials or workmanship and providing that the Contractor shall promptly make such corrections as may be necessary by reason of such defects at no cost to the Water Resources Department upon reasonable notice by the Water Resources Department. Reasonable notice shall be 7 days for non-emergency corrections, but may be as limited as 4 hours if the defect has resulted in a threat to public health and safety or an interruption of water service to a customer. In the event the Contractor fails to make the repairs, adjustments, or other work required to correct the defect within the reasonable notice, the Water Resources Department may make the repair and charge the Contractor the cost incurred.

In the event the Developer cannot obtain a written warranty from the Contractor, the Developer may provide a written warranty through a performance bond or a letter of credit in the amount of 50% of the cost of the construction cost of the extension or modification project.

B. Warranty Inspection

A warranty inspection is scheduled and facilitated by a Water Engineering inspector with the Developer/Contractor within 30 days prior to expiration of warranty period. During the warranty inspection it will be verified that the water system and all appurtenances are in good working order and that there are no workmanship defects with the water system or associated construction work such as trenches, asphalt overlays, etc. If necessary the construction inspector will prepare a punch list of items to be corrected by the contractor. After notification by the contractor that any required corrections are made, the inspector will re-visit the site to verify completion and issue release of the warranty.

C. Repair of New Waterlines

1. Water Main Repairs: Joint Leaks, Line Breaks, or Punctures on new water mains shall be repaired by replacing the damaged section of ductile iron pipe with a mechanical sleeve. The use of wrap around sleeves will not be allowed on new water pipe.

2. Water Service Line Repairs: A water service line severed between the water main and the water meter shall be repaired using new type K copper tubing and bronze or brass 3 piece compression unions.

W3 WATER MAINS:

A. Material:

All water mains shall be constructed of ductile iron pipe and fittings as specified by AWWA C150 and C151 for laying conditions per the City of Asheville Standard Trench Detail and as required by the Technical Specifications. All water main pipe and fittings shall be rated for a working pressure greater than the highest design static pressure in the location where the pipe is being provided. At a minimum, all pipe and fittings 12 inches or less shall be rated class 350 PSI and pipe and fittings larger than 12" rated class 250 PSI.

B. Size:

All water mains shall be sized in conformance with the latest Water Distribution System Master Plan adopted by the Water Resources Department. In locations not provided for in the Master Plan, the standard size water main shall be 8 inches in diameter. However; a water main may be 6 inches in diameter within local areas of distribution where the extent of present and future service demand can be fully defined and adequate residual water pressure can be maintained throughout as required by the Water Policies. The predicted residual pressure shall be confirmed through engineering hydraulic calculations, for both peak domestic flow conditions and a maximum fire flow condition during average day demand using a friction coefficient equivalent of C=120. The maximum allowable length of a dead-end 6-inch main is 2,000 feet; provided that the Director may grant an exception when all of the following are true:

(1) The existing main at the point of connection is 6 inches;
(2) The proposed extension as a 6-inch main will provide adequate volume and pressure over its entire distance, including peak demands and fire protection;
(3) The most recently adopted Master Plan does not specify otherwise for this location;
(4) There is no practical means to connect the extension to another existing main 6 inches or larger anywhere along its route.

[*When the proposed main passes within 400 feet of an existing main 6 inches or larger and a connecting water main can be placed across this separation in accordance with this Manual, connection is considered practical.*]

C. Parallel Waterline Installations:

Waterline extensions proposed in areas where smaller diameter water mains already exist shall be built in a way to avoid duplication of maintenance responsibilities. As a minimum, the design of such mains shall include re-connection of all existing water meters and abandonment of the existing smaller diameter main within the limits of the water extension area. In areas where the new main does not extend the entire length of the existing waterline, the design shall show a connection back into the existing main at a convenient location near the terminus of the proposed waterline.

D. Thrust Restraint:

All fittings, bends, tees, crosses, valves shall be adequately restrained. Approved restraint includes retaining glands, field lock gaskets and restraint systems provided by approved pipe manufacturers. Minimum restrained lengths for pipe diameters up to 10 inches and working pressures up to 200 PSI, shall be as indicated in Figure W05:

Figure W03-a: RESTRAINED LENGTH CHART

Recommended Minimum Restrained Length Required Each Side of Fitting (Feet)					
Fitting Type	Size	Working Pressure (PSI)			
		125	150	175	200
Horizontal 11 1/4 Deg.	6"	4	4	5	6
	8"	5	6	7	8
	10"	6	7	8	9
Horizontal 22 1/2 Deg.	6"	7	9	10	12
	8"	10	12	14	16
	10"	12	14	17	19
Horizontal 45 Deg.	6"	16	19	22	25
	8"	20	24	28	33
	10"	25	30	35	40
Dead End	6"	26	31	36	41
	8"	34	41	48	55
	10"	42	50	58	67
Reducer	8"x6"	14	17	20	23
	10"x8"	14	17	20	23
	12"x10"	14	17	20	23
Tee	To be calculated on a case by case basis.				
90 deg. and Vertical Bends	To be calculated on a case by case basis.				

In all cases above, the minimum restrained joint lengths will be equivalent to standard full length pipe joints.

Restrained lengths for fittings 12 inches and above and for areas where the operating pressure is above 200 PSI shall be calculated by the engineer of record and submitted for approval.

Straight lengths of pipe that are installed on or along roadways with grades exceeding 12%, within steel encasement pipe, where there are special laying conditions or unusual installation locations; shall be adequately restrained by approved methods. Otherwise straight lengths of pipe, regardless of size and system operating pressure, are not required to be restrained.

The use of poured concrete thrust blocks will be permitted, as depicted in the pertinent Standard Detail, where connections are made to existing waterlines or under other such special conditions where use of mechanical restraint is not feasible. The use of pre-cast concrete thrust blocks shall not be permitted.

The use of a concrete dead-man and steel rods will be allowed for the installation of end-of-line plugs, as depicted in the pertinent Standard Detail.

E. Water Main Location and Installation Requirements

Water mains shall be located outside paved or otherwise improved surfaces in a minimum 5 foot wide grassed utility strip, free from trees, bushes and/or above ground structures. Waterlines are to be installed on the cut side of slopes where possible.

For special circumstances, such as Urban Villages or Hillside Developments, water mains may be permitted to be installed under roads, sidewalks or similar hardscaped areas. These variances are granted on a case by case basis only after it has been deemed that it is not feasible to adhere to the standard location requirements. When waterlines have been permitted to be installed under private roads, sidewalks or similar hardscaped areas, an Estoppel Certificate must be executed by the applicant stipulating that the City of Asheville will not be liable for road, sidewalk repairs or any other surface improvement repairs necessitated by any water operation or water maintenance activity.

Waterlines not following a public or private road /drive meant for vehicle ingress and egress are deemed cross-country waterlines. Cross-country waterlines are allowed on a case by case basis. At a minimum a 12 foot wide all-weather access road with a grade of no more than 15% must be provided along the cross-country waterline route and all other applicable standards adhered too. Additional requirements for cross-country waterlines may be applied at the Director's discretion.

All water mains shall be specified to be installed with a standard minimum ground cover of 3 feet but not greater than 5 feet of ground cover, except where prohibitive conflicts of limited distance require deeper installation. Ground cover shall be measured as the distance from the top of the pipe to final grade. When grading is to be altered during construction, the proposed final grade shall be shown on the plans for water system construction. Sections of water main deviating from 3 feet of cover shall be profiled on the plans. The profile must show waterline elevations, existing and or proposed ground elevations and the item(s) in conflict.

Water mains shall not be installed along roads or land with slopes greater than 18%. Where water mains are installed along roads or land sloping greater than 12%, the following minimum special provisions must be met, to ensure the adequacy for moving and utilizing construction equipment and for maintenance and repair:

1) Use of restrained joint type;
2) The depth of cover shall not exceed 36-inches to the top of the pipe.
3) New waterline(s) must be installed above all other underground utilities.

Subject to the approval of the Water Resources Department, a waterline may be installed on a 2:1 slope (50% slope) for a maximum length of 40 feet. Isolation valves must be installed on the water at the top and bottom of slope. In these cases, the pipe shall be restrained and installed no deeper than 36 inches to the top of the pipe. There is to be flat area at the top and bottom for adequate working conditions. Other slope and length variances shall be reviewed and approved on a case-by-case basis.

See the Technical Specification for Ductile Iron Pipe for more detail regarding waterline installation.

F. Relation of Water Mains to Other Utilities, Structures and Trees

Sanitary Sewer: Water mains shall be laid at least 10 feet laterally measured edge to edge from existing or proposed sanitary sewer. If the elevation of the bottom of the water main is at least 18 inches above the top of the sanitary sewer a clear horizontal separation of at least 3 feet is allowable.

Where a water main and a sanitary sewer cross, the minimum vertical separation is 18 inches between the bottom of the waterline and the top of the sanitary sewer line. If the vertical separation is less than 18 inches or the waterline passes under the sanitary sewer; the water main and the sewer line shall be ductile iron pipe equivalent to water main standards for a minimum distance of 10 feet on each side of the crossing. Water mains should only cross-sanitary sewer mains at an approximate 90-degree angle.

The minimum distance of the water main to the outside edge of manholes shall be 5 feet when the sanitary sewer line is at least 18 inches below the waterline and 10 feet under other circumstances.

Storm Drain: Water mains shall be laid at least 10 feet laterally measured edge to edge from existing or proposed storm drain. If the elevation of the bottom of the water main is at least 12 inches above the top of the storm drain a clear horizontal separation of at least 3 feet is allowable. Where a water main and storm sewer main cross the minimum vertical separation is 12 inches and the crossing should be at an approximate 90-degree angle.

Natural Gas Mains, Cables, and Other Utilities: Other utilities shall have a minimum horizontal clearance of 3 feet and vertical clearance of 12 inches, to permit proper maintenance of the water main.

Gas and other Utilities with Cathodic Protection: Waterlines are to be installed away from stray currents and outside the areas of influence caused by corrosion prevention systems, or other sources of corrosion causing currents. When this is not practical, the iron pipe is to be protected by polyethylene encasement in accordance with ANSI/AWWA C105/A21.5, and extending on either side beyond the limits of the area of influence; or be protected by other approved methods that are acceptable to the Water Resource Department.

Structures and Trees: A minimum of 10 feet horizontal distance is required from all retaining walls or structures to new waterlines. Care shall be taken to locate waterlines outside of zones of

influence for structure and wall foundations. A minimum of 5 feet horizontal distance is required between waterlines and utility and/or light poles. A minimum of horizontal separation of 3 feet is required between waterlines and the drip line, at maturity, of trees and other shrubs.

G. Right-of-Way, Easements and Access:

All water distribution system extensions or modifications to be owned and maintained by the City of Asheville shall be within a publicly-owned and maintained street right-of-way or within a permanent utility easement at least 20 feet in width. Preference shall be given to street rights-of-way over utility easements when practical. Prior to project approval, any necessary encroachments must be approved and provided to the City of Asheville, for waterlines within existing rights-of-way.

Permanent utility easements shall be of legal form satisfactory to the City of Asheville Attorney's Office and shall reference a plat prepared and sealed by a registered land surveyor showing the exact location and dimensions of the easement. The plat may be referenced as a separate recorded map or be recorded as a referenced attachment to the easement form. After approval is received from the Water Engineering Inspector, all permanent easements shall be recorded in the office of the Register of Deeds in the county where the property is located.

The utility easement shall be sufficient to allow continuous adequate access for maintenance of the water main. No permanent above ground structures, brush/trees, or other impediments to access, shall be permitted within the easement, except as provided under the requirements for relation of water mains to other utilities, structures and trees. The easement shall permit the construction and maintenance of improved all-weather roads for access as necessary. Water Resources Division may require sufficient permanent utility easements to be dedicated to the City of Asheville which will permit future waterline extensions to all adjoining property.

All permanent water utility easements shall exclude the use of the easement for utilities other than water unless pre-authorized by the Director as a joint-use utility easement. For joint-use easements minimum horizontal separation requirements above, shall be enforced by the Grantor and the Grantor shall further be responsible to the City of Asheville to enforce repair or corrective work for damages or limitations of access to the Water System caused by other utilities.

For waterlines that are to cross the land not belonging to the applicant/developer all permanent easements shall be obtained, platted, recorded and granted to the city ahead of final plan approval. All easement forms and plats must conform to the requirements outlined in previous paragraphs.

H. Steel Encasement Pipe:

Encasement Pipe must be used for all bore installation of water main, at all creek crossings and other locations as deemed necessary by the Water Resources Department.

The steel encasement pipe must be at least 8 inches larger than the nominal diameter of the carrier pipe and be compliant with the appropriate standard details and the Technical Specification for Encasement Pipe Installation.

W4 FIRE HYDRANTS AND FLUSHING DEVICES:

A. Hydrant Materials

All fire hydrants shall meet or exceed the requirements of AWWA C-502, be listed by Underwriters Laboratories, Inc. and have Factory Mutual Research approval. All hydrants shall be rated 250 PSI working pressure minimum and be tested to 500 PSI minimum. The rated working pressure shall be cast on the hydrant barrel. All fire hydrants shall have two 2 ½" hose connections and one 4 ½" pumper connection, a 6" shoe and a 4 1/2" main valve opening. Hydrants shall be of the compression type, constructed such that the main valve closes with water pressure to assure no loss of water in the event of damage to the upper portion of the hydrant. . The hydrant operating nut shall open left or counter clockwise.

For fire hydrant information, see the Technical Specification for Valves and Appurtenances. A list of approved fire hydrants is included in the Approved Manufacturers Products List.

B. Installation, Location and Spacing of Fire Hydrants

Fire hydrants shall be supplied by water mains at least 6 inches in diameter. A gate valve shall be provided on each branch line to fire hydrant assemblies and shall be located within 24 inches of the hydrant branch tee. When a hydrant is located on the opposite side of the street from the water main a second valve must be installed within 3 feet of the hydrant base.

All fire hydrants shall be installed plumb with permanent surrounding grade at the "bury line" cast on the hydrant; grade shall not be "dug out" or mounded around the hydrant to satisfy this requirement. Fire hydrants which have been installed must be tagged "OUT OF SERVICE" or bagged until such time as the water main to which connected is disinfected and connected to the active water system.

Fire hydrants shall be located at street intersections whenever possible; however, additional fire hydrants may be located between intersections when necessary to meet spacing requirements. Hydrants between intersections shall be located adjacent to boundaries between adjoining properties in subdivided areas. Hydrants shall be staggered on waterlines along divided highways. Hydrants shall be located in accordance with the City of Asheville Standard Detail for Hydrant Location.

The maximum distance between hydrants, measured along the street centerlines, shall be 500 feet. In cul-de-sacs and dead-end waterlines, the last hydrant shall be at the end of dead-end waterline and shall serve as a blow-off assembly.

When new buildings are constructed or existing buildings are expanded, required fire hydrants shall not be determined by requirements of the NC Fire Prevention Code. Contact the Asheville Fire Department, or the fire department having jurisdiction in the project area, to determine required fire hydrant locations.

The fire hydrant locations shall be coordinated with the parking and street design. The requirements and specifications for fire hydrant installation adjacent to parallel parking or within parking spots are separately provided by the Transportation and Engineering Department and can be viewed accessing the City's web site www.ashevillenc.gov or by contacting the City's Transportation Department.

C. Fire Hydrant Ownership

Publicly Owned Fire Hydrants: Fire hydrants located along public street right-of-ways, or within public utility easements, and connected to the Water Distribution System, shall be owned, operated and maintained by the City of Asheville as part of the Water Distribution System.

Additional fire hydrants on private property meeting the requirements of the AFPC (City of Asheville Fire Prevention Code) or the Fire Official, may be publicly conveyed to be part of the Water Distribution System under one of the following conditions:

(1) If the Director determines that an extension of a water main with fire hydrants across the private property, to be part of the Water Distribution System, is necessary for the overall public benefit of the Water Distribution System and the private property owner grants a public utility easement along the extension to the last fire hydrant;

(2) If a 6-inch or larger branch waterline with fire hydrant is extended not greater than 100 feet beyond the public right-of-way or easement where the water main is located, provided continuous access by fire engine or water service and maintenance equipment is provided and the hydrant is visible along such access, and a public utility easement is granted over the waterline to the hydrant.

At Water Resources Staffs discretion a swing check valve may be required on the waterline extension to protect the rest of the public system from backflow conditions.

Privately Owned Fire Hydrants: All fire hydrants located beyond a City of Asheville master water meter shall be privately owned and maintained. Fire hydrants installed on a dedicated fire line shall also be privately owned, operated and maintained.

D. Required Fire Flows

Neither the City of Asheville nor the Water Resources Department provide any guarantee of the Water Distribution System's capability to deliver water flow and residual pressure the Fire Official may require for fire protection. It is the sole responsibility of the Developer to provide for an adequately designed fire suppression system, extension and improvement of the Water Distribution System, or both, as necessary to meet the requirements of the Fire Official to protect the land and building improvements to which the Water System, will serve. This shall also apply where distribution system pressure exceeds the manufacturer's pressure specifications.

Where building sizes have not been determined, the minimum base fire flow shall be 500 GPM for single family dwellings and 1000 GPM for other uses. The above flows will be used to verify compliance with the established minimum residual pressure requirements of 40 PSI and 20 PSI for domestic and fire flow conditions, respectively.

For specific fire flow requirements contact the Asheville Fire Marshal's Office or contact the fire department having jurisdiction in the project area. Additional fire flow requirements for the City of Asheville Fire Marshal can be viewed under the Engineering City of Asheville's Standard Specifications and Details Manual.

The Owner/Developer of the extension or modification to the Water Distribution System shall demonstrate by actual fire flow tests that the system will supply the required fire flows. For public fire hydrants these tests are conducted by the Water Resources Department. It is the Owner/Developer's responsibility to pay the required fees for the test. For private fire hydrants the Owner/Developer must pay the required fees for the test, coordinate the tests through the Asheville Water Department or contact the fire department having jurisdiction in the project area.

E. Temporary Blow-offs

Blow-offs may be installed at the end of all temporary dead-end waterlines which are required due to project phasing where it is not practical to install a permanent fire hydrant. Temporary blow-offs shall be installed per the pertinent Standard Detail.

F. Flushing Devices

Fire hydrants shall serve as points of flushing in most situations.

The Water Resources Department may require the installation of Automatic/Remote Operated Flushing Assemblies, equipped with metering device, for water system extension projects for which the built-out process may take considerable time after completion of water system construction, and the total length of waterline installed is such that water quality can be compromised by lack of circulation. Requirements for such installation will be decided on a case by case basis. Automatic flushing assemblies can either be a stand-alone unit or a unit attached to a fire hydrant and shall be as specified in the Approved Manufacturers Products List.

Disposal of the chlorinated water during flushing shall comply with all federal, state, and local regulations.

W5 VALVES

A. Main Line Valve Types and Materials

1. Ball valves shall be installed on waterlines less the 2 inches in diameter and shall conform to AWWA C800. Ball valves shall be rated for 300 psig working pressure. Operating nut shall be "curb key" design for quarter turn open or close and shall open left.

2. Gate valves shall be installed on all waterlines 6 inches and 8 inches in diameter. Gate valves shall be resilient seated gate valves manufactured to meet or exceed the requirements of AWWA C-509 of latest revision, be listed by Underwriters laboratories, Inc. rated for 200 psi operating pressure and have Factory Mutual research approval.

3. Butterfly Valves shall be installed on all waterlines 10" and greater in diameter All valves 10-inches shall be butterfly valves. The butterfly valves shall be rated for 250 PSI working pressure and be in accordance with applicable AWWA standards.

See the Valves and Appurtenances Technical Specification for more technical valve detail. Also, for approved valves, see the Approved Manufacturers Products List.

B. Valve joints and operating direction

All valves for water mains shall be for underground installation with mechanical joint connections (except tapping flange on tapping valves). All valves shall open left or counterclockwise, and except for 2-inch ball valves, all valves shall have a 2-inch square operating wrench nut. Wrench nut shall be within 3 feet of the top of the valve box.

C. Location

Valves shall be installed within 24 inches of branch fittings (either tee or cross) at the intersection of two water mains, or a water main and either a hydrant or blow-off branch line. Maximum separation between valves along a water main shall be 1000 feet for valves up to 10 inches in size. Higher separation, up to 2,000 feet or as required at strategic locations, may be allowed for valves larger than 10 inches.

1. The number of valves at a branch fitting shall be determined as illustrated in City of Asheville Standard Detail for Valve Configuration and described as follows:

2. At a cross fitting with only one direction supplying from the water source, a minimum of three valves shall be installed, one on each of the "dead-end" directions.

3. At a cross fitting with three directions supplying from the water source, a minimum of three valves shall be installed, one in each supply direction.

4. At a cross fitting with two directions supplying from the water source, four valves shall be installed, one in each direction.

5. At a cross fitting with all four directions supplying from the water source, three valves shall be installed in the directions with smaller diameter mains (if the main size is the same in all directions, designer choice).

6. At a tee fitting with only one direction supplying from the water source, a minimum of two valves shall be installed, one on each of the "dead-end" directions.

7. At a tee fitting with two directions supplying from the water source, a minimum of two valves shall be installed, one in each supply direction, except at a hydrant tee one valve shall be on the hydrant branch and the second on either side of the tee.

   When there already exists a valve within 200 feet of a tee or cross intersection in one or more directions and the requirements above would specify a new valve in that direction, the existing valve is deemed to be sufficient and an additional valve in that direction is not required.

When compliance with the above standards requires that a fitting and/or valve(s) be cut into an existing water main during a service interruption, the Contractor shall include in the tie-in the installation of an additional valve at no additional cost provided that the Water Resources Department furnishes the additional valve and accessories to the Contractor.

D. Tapping valves

All tapping valves shall be resilient seat gate valves furnished with a tapping flange in accordance with MSS SP60 and drilled and faced in accordance with 125 pound standard. The branch opening shall be mechanical joint and compatible with Mueller tapping equipment. Tapping valves shall otherwise conform to the standards for a gate valve.

E. Air Release Valves

Air release valves shall be float-controlled automatic air release valves installed at all high points of waterlines. Air release valves must meet the requirements of AWWA C512. Air release valves 2 inches or smaller shall be installed according to the City of Asheville Standard Air Release Valve Installation Detail; 4 inches and larger air release valves shall be installed according to Standard Detail for 4" and Larger Air Release Valve. The size of the air valve shall be designed by the Engineer.

F. Pressure Reducing/ Pressure Sustaining Valves

Pressure control valves will be required where normal operating pressures are calculated to exceed 200 psi. Parallel valve installations will be required with a minimum of 2 control valves. Typical installations would have 2-inch control valve for low flow conditions and an appropriately sized larger valve for peak demand conditions, including fire flow. These control valves shall be installed in a manhole structure in accordance with the City of Asheville Standard Details for Main Line Pressure Reducing and Pressure Sustaining Valve Station details.

The operation of pressure reducing / pressure sustaining valves shall be monitored and controlled remotely with the use of a telephone line controlled SCADA system. Conditions monitored by SCADA include: intrusion alarm, inlet pressure and outlet pressure. See the SCADA Instrumentation & Control Technical Specification for more detailed SCADA requirements.

See the Approved Manufacturers Products List for approved pressure reducing / pressure sustaining valves.

G. Flow/Level Control Valve Actuators

An electronic actuator shall be used to control the position of the butterfly control valve. The actuator shall be of the multi-turn type, driven by an electric motor. The actuator shall have both electric and torque switching for proper open/close operation. For approved control valve actuators see the Technical Specification for SCADA Instrumentation & Control.

W6 WATER SERVICE SETTINGS AND METERS:

A. General Requirements for Service and Meter Installations

All platted lots, whether existing or proposed as part of a subdivision, shall have a separate water service connection to a distribution main without crossing adjacent lots. No individual water meter may serve more than one property. There shall be only one customer responsible for the bill for all metered water consumption on each individual water meter as defined by Water Policies.

All service connections shall be made perpendicular from the main line, shall run straight to the meter, and be located directly in front of the building served.

All water mains shall be extended such that all water meters are on or immediately adjacent to the property being served, unless approved otherwise by the Director.

Where meters are provided to serve more than one building on the same property, each meter shall be located directly in front of the building served and the meter boxes shall be clearly labeled to describe the address of the building served. A permanent nameplate with engraving of address shall be permanently secured to the interior wall of each meter box within 3” of the top of the box, of non-corrosive materials. The developer or builder is also responsible for insuring that plans for construction define which meter goes with which unit or building, and that the plumber hired to connect the plumbing to the building or units connects the plumbing to comply with the schedule shown on the plans and labeled on the meter boxes.

All construction of water main extensions to serve new single-family residential subdivisions shall include the extension of service lines, meter boxes, and meter fittings, except the water meter, all in accordance with the Technical Specifications. Where possible, domestic and fire service connections shall be included in water main extensions to commercial / industrial

property. At a minimum, a 6-inch waterline shall be stubbed out to each property and capped at the property line. All service lines, meter boxes, and meter vaults to be constructed as part of the water main extension shall be shown to scale on the approved plans for construction.

The length of all water service pipe shall be such to avoid any unions between the corporation stop and the water meter. Service lines in excess of the commercial length of a roll of copper pipe shall be of ductile iron class 350 water pipe.

In residential areas, meter boxes shall be located 3 to 5 feet beyond the edge of pavement or back of curb as applicable, in a flat area, away from steep slopes. Water meters shall not be located in drainage ditches, sidewalks, driveways, parking areas or other areas where they are susceptible to vehicular traffic. Where adequate space is not available between the edge of pavement and drainage ditches, the meter box shall be located beyond the drainage ditch at the first possible location; maximum 3 feet beyond the ditch.

In certain circumstances, specifically within the Central Business District, meter boxes may be approved for placement in public sidewalks, but water service will be limited to one meter per building.

All master meter vaults shall be located outside the street, sidewalk, or parking areas, away from vehicular traffic, and within an easement area immediately adjacent to the road right-of-way. The easement area shall be a minimum of 20 feet wide and shall extend approximately 10 feet from the back of the vault.

For more detailed information regarding service taps, see the Water Service Connections Technical Specification.

B. Types of Water Service

1. Domestic Services: Individual water services shall be provided from the main to each water meter for single family residences in accordance with the City of Asheville Standard Detail for 5/8" to 3/4" Water Meter Box.

   "Split connections" may be permitted, whereby a 1-inch tap and 1-inch service line serves 5/8-inch meters, constructed in accordance with the City of Asheville Detail for Standard Multiple Branch Services, under the following conditions: (1) on or adjacent to a lot with two or more meters serving two or more buildings (maximum 1 meter per building); or (2) along a property line where the developer or builder is providing meters to each of two adjoining lots, provided each meter is on the property being served.

2. Irrigation service: All irrigation services, according to NC State Law, shall have a separate metered service line. All irrigation services are considered high hazard in relation to backflow protection requirements and must be protected with a reduced pressure principle backflow prevention assembly, installed in an above-ground heated, insulated ASSE 1060 enclosure, and in accordance with all applicable regulations.

   All irrigation services shall serve no more than one individual property and shall not connect with any building structure or with any other consumptive-use water service.

3. Residential Fire Sprinkling: Fire sprinkler heads may be installed on residential domestic plumbing lines. These combined systems must be on a single service line and single meter. The meter shall be an UL/FM approved fire service turbine meter and shall be sized for the peak fire flow requirement. Dedicated fire service lines for single and duel family residential dwellings may be approved on a case by case basis. These dedicated services must be served be a separate service tap from the residential system. They must be metered utilizing an UL/FM approved fire service turbine meter, sized for the peak fire flow requirement. Adequate backflow protection is required on all dedicated fire lines.

4. Combination Fire and Domestic Water Service: Combination fire and domestic water service will be required for all commercial, institutional and industrial applications where domestic and fire protection services are to be provided. The master meter assembly shall be installed in a below ground vault in accordance with the City of Asheville Standard Detail for Combination Meter/Vault Enclosure and shall be located per the requirements for master meters. Adequate backflow protection is required. Waterline extensions beyond the combination fire/domestic master meter must be designed and constructed in accordance with this manual to a point within 5 feet of entry to a structure.

   Dedicated fire lines which incorporate private fire hydrant connections must be fully metered. Adequately sized UL/FM approved fire service turbine meters are to be used for metered dedicated fire lines. For metered dedicated fire lines; the connection, isolation valve, meter and fire line up to the meter shall be owned and maintained by the City of Asheville and the remainder components, beyond the meter shall be owned and maintained by the customer.

5. Dedicated Fire Lines: Under certain conditions, a variance to the requirement for combination fire and domestic water service may be granted. The variance will allow for installation of a flow detector, in lieu of a combination water meter, on an individual dedicated fire line which does not incorporate private fire hydrants. The flow detector must be factory built into the required backflow assembly. If the variance is granted the Customer must agree to execute and abide to the terms of a provided special Estoppel Agreement, which gives the City the authority to require a full size water meter be installed on the dedicated fire line at full cost to the customer if unauthorized flows are detected. All non-metered dedicated fire lines must have an isolation/tap valve, installed at the connection point to the public water main. The connection and the isolation valve shall be owned and maintained by the City of Asheville and the remainder components, beyond the isolation valve shall be owned and maintained by the customer.

6. Additional Fire Line Requirements: All water connections for fire suppression systems, with the exception of those combined with domestic service for single and duel family residential dwellings shall be designed by a North Carolina registered professional engineer and reviewed by the Water Engineering Division for approval.

Dedicated fire lines may have branch connections only to private water storage or booster pumping facilities which are solely to and constitute part of the fire suppression system; branch connections or plumbing for any other purpose is strictly prohibited.

No fire suppression system shall be designed or installed on a fire line connection to the Water Distribution System which when operating will reduce the public water system residual pressure below 20 PSI.

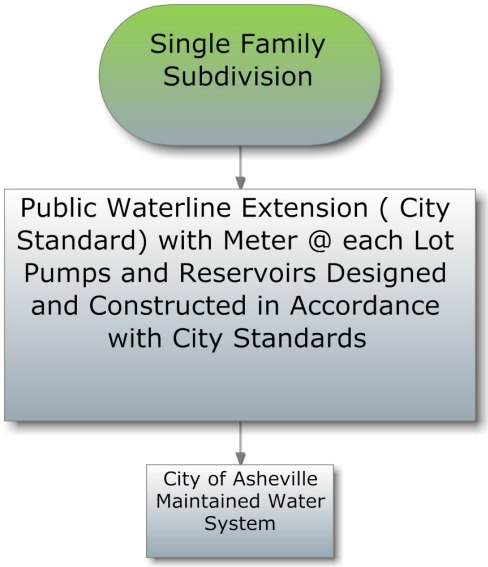
Where sprinkler systems are used, a fire department connection shall be provided on the building or as otherwise approved by the Fire Official. Connection location(s) must be approved by the Fire Official. Where sprinkler systems or a riser room are required, outside access in accordance with the N.C. Building Code shall be provided.

The City of Asheville reserves the right to bill the owner/developer for the consumption of potable water used to test dedicated fire lines and sprinkler systems.

C. Methods of Metering

The following flow charts depict the allowable methods of metering for various development types within the City of Asheville water system service area. Some development types have the option of extending the public water system, for City of Asheville ownership and maintenance, within private streets and or rights-of way. As a condition for approval of the installation of a public water system on private property, the Developer must grant to the City of Asheville a Permanent Waterline Easement and a properly executed Estoppel Certificate stipulating that the City of Asheville will not be liable for road, sidewalk repairs or any other surface improvement repairs necessitated by any water operation or water maintenance activity.

Figure W06-a: APPROVED WATER SERVICE METHODS



Mobile home parks shall be master meter, unless the park has been subdivided and lots are individually owned then they shall be treated the same as single family subdivisions.

Figure W06-b: APPROVED WATER SERVICE METHODS

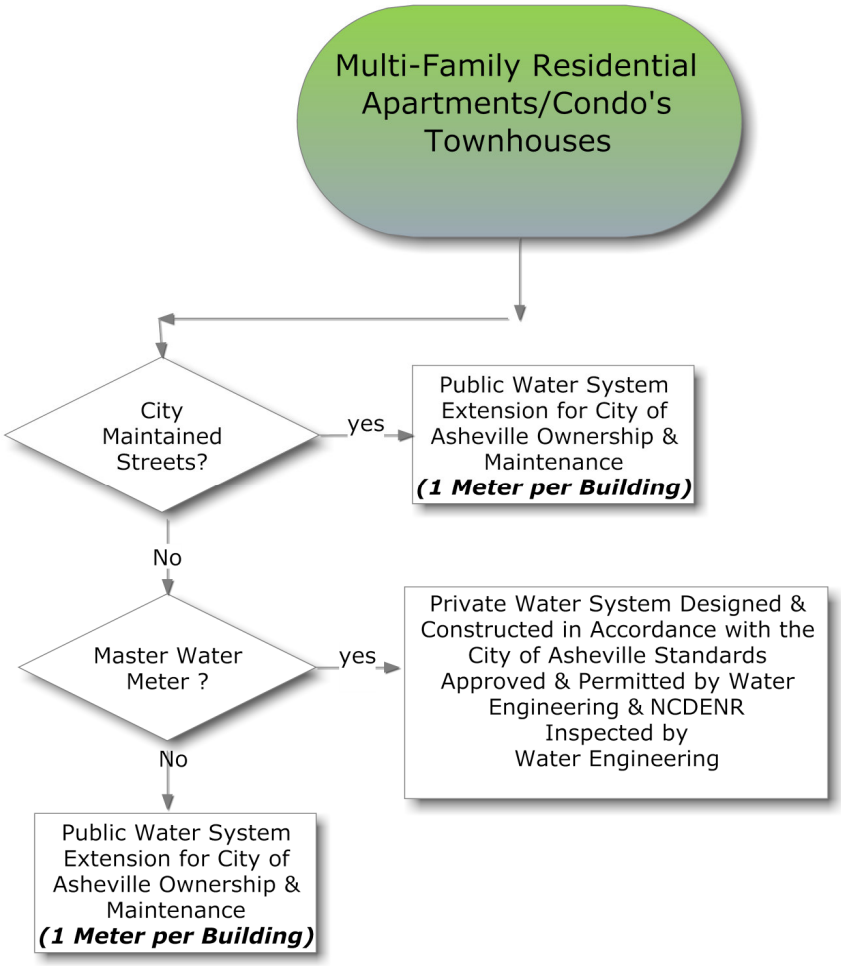


Figure W06-c: APPROVED WATER SERVICE METHODS

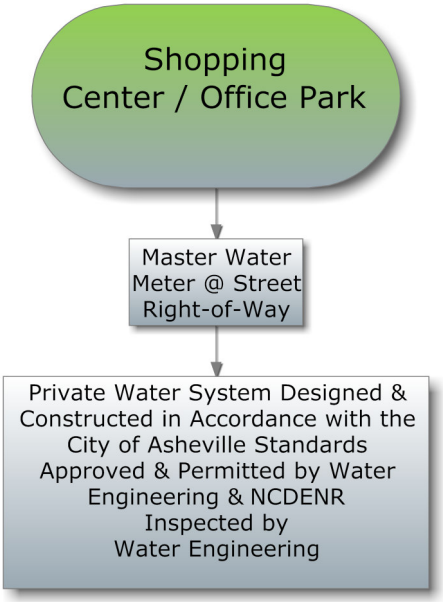
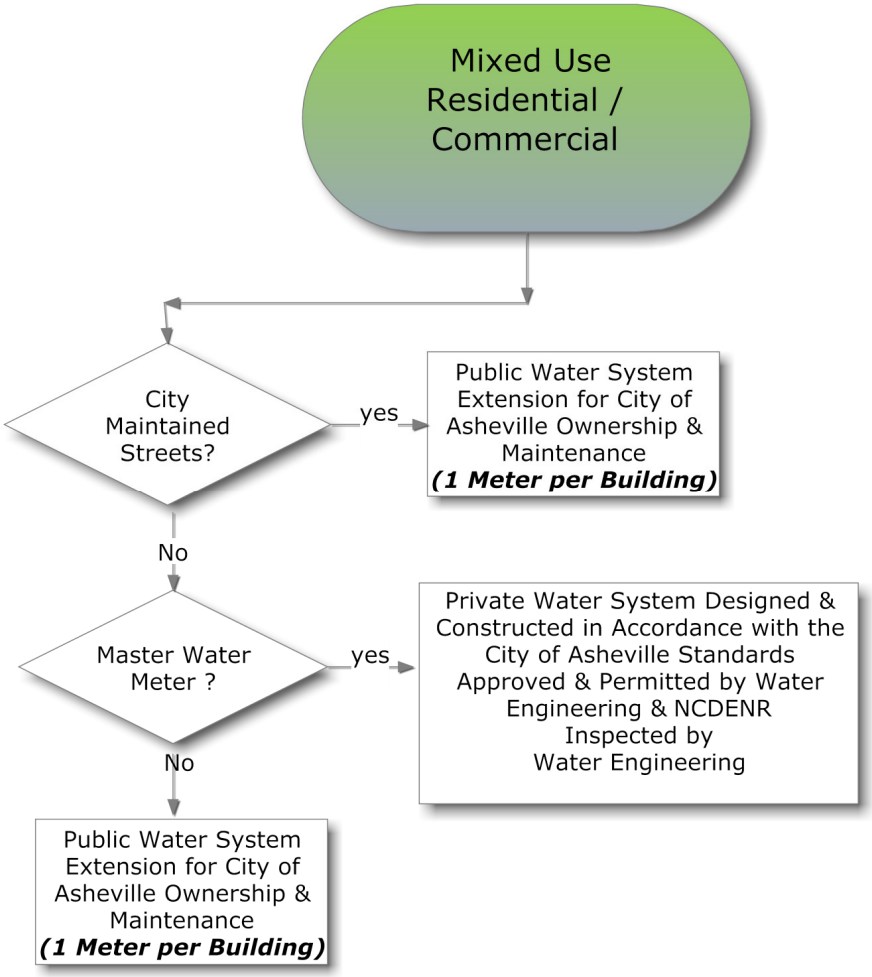


Figure W06-d: APPROVED WATER SERVICE METHODS



D. Meter Types & Sizes

The size and type of water meter shall be reviewed by the Water Resources Department based on type of facility receiving service, projected peak water demand, and expected fluctuation in water demand, and shall be selected to insure high standards for accuracy for all service conditions. The size shall be the smallest, which is designed for a normal test flow rate covering both the minimum and maximum flow rates expected by the customer.

Non-single family residential peak water demands shall be calculated using the fixture unit values and demand curves shown in Figures W03-b,W03-c, W03-d & W03-e found on pages W-12 & W-13 of these Standards.

These Figures are taken from the "Rules Governing Public Water Systems" T15A NCAC18C.0802 as published by the North Carolina Division of Environmental Health / Public Water Supply Section. An accepted alternative to this peak demand calculation is the fixture unit assignment and gallons per minute calculations included in Appendix E of the North Carolina Plumbing Code (latest revision).

Water meters from 5/8-inch to 2-inch in size shall be positive displacement meters as specified by AWWA C700 and shall be provided by the Water Resources Department. Water meters greater than 2" shall be lead free compound type (AWWA C702) except as follows: where combination fire and domestic meters (AWWA C703) are approved or at locations where Class II turbine type meters (AWWA C701) are approved in writing by the Director. The Director's authorization of turbine meters shall be limited to those premises where intervals of water demand at a rate lower than the lower limit of the normal test flow rate of the meter for its size, as defined by AWWA C701, is highly improbable. Full size dedicated fireline meters shall be turbine meters complying with AWWA C703.

Figure W08-e: Water Meter Sizing Table

COMPOUND METERS

Nominal Meter Size (inches)	Safe Maximum Operating Capacity (gpm)
3	320
4	500
6	1000

POSITIVE DISPLACEMENT METERS

Nominal Meter Size (inches)	Safe Maximum Operating Capacity (gpm)
5/8	15
¾	30
1	50
1½	100
2	160

E. Pro-read Registers and Remote Reading Pads

All water meters in vaults and all detector meters located on backflow preventers, located either in a vault or inside the building shall be furnished with remote reading capabilities compatible with City meter reading equipment.

Combination fire and domestic water meters shall be furnished with City compatible remote reading capabilities meter reading equipment on both the turbine and by-pass meters.

All meters shall be provided with an automatic meter reading (AMR) device. This device shall be in accordance with the Approved Manufacturers Products List.

Accuracy performance will conform strictly to current AWWA standards as well as all loss of head requirements.

The City prefers that meters be programmed with the ID number being the same as the serial number of the meter. However, meters with a factory programmed ID number different from the meter serial numbers will be accepted.

F. Materials for Services

1. General: All new brass water service fitting, in direct contact with water, shall be made of a "No-Lead Brass", defined for this specification as EnviroBrass II, UNS Copper Alloy C89520 per ASTM B30 and ASTM B584 or approved equal. The Mechanical properties and Chemical composition of the "No-Lead Brass" Alloy shall be certified by an independent testing agency. This "No-Lead Brass" alloy shall contain not more than one fourth of one percent (0.25% or less) total lead content by weight.

   All brass fittings and valves shall have the manufacturers name or trademark integrally stamped or cast on it. Another marking identifying the "no lead" brass alloy, e.g., 'EB2' or "NL", shall be cast or stamped on the fitting or valve.

   The only exception to this requirement is for brass unions, brass nipples, brass bushings and brass bell couplings which shall be made of 85-5-5-5 brass as defined for this specification as UNS Copper Alloy C83600 per ASTM B30, ASTM B62, ASTM B584 and AWWA C-800.

   All brass fittings and valves shall be certified by an ANSI accredited test lab per ANSI/NSF Standard 61, Drinking Water Components – Health Effects, Section 8. Proof of certification is required

   The use of galvanized iron, steel, or plastic fittings with copper and other higher-grade specified materials shall not be permitted or accepted in water service connections.

   All service line fittings shall be designed for connection to the service line by compression. No solder, brazing and flaring connections will be allowed.

2. Copper Service Tubing: Shall be type K soft copper tubing per ASTM B88 for service lines. The longest available length of service line should be used with no unions. As an example for a 3/4-inch service connection, no union shall be used in the installation of 60 feet or less. For 3/4 inch, only 1 union will be allowed for each 100-foot section or fraction thereof. Unions shall be made with pack joint fitting with a retaining screw

3. Tapping Saddles
   The Contractor shall furnish and install iron body double strap service saddles complying with the following:

   Bodies: Ductile Iron ASTM-A536
   Straps: 5/8-inch AISI C1010 Steel, Zinc plated with Di-chromate seal.
   Nuts: Cold formed heavy hex steel A563, electro-galvanized with dichromate seal.
   Gasket: Buna-N rubber, ASTM-D2000
   Finish: Shop Coat Enamel

4. Ball Valve Corporation Stops The ball valve corporation stops shall have a PTFE coating approved for use in potable water and be supported by two Buna-N rubber seals that are held and sealed in place with adhesive. The operating stem shall have a head that clearly indicates the flow direction. The stem shall be equipped with an O-ring seal to assure against external leakage and a flange to prevent blowout.

   All Ball valve corporation stops shall be designed to have a working pressure of 300 PSIG. The throughway dimension shall be no smaller than the nominal size of the valve. All ball corporation stops must be designed so they can be installed under pressure with standard tapping machines and insertion tools. All threads shall conform to the current AWWA C-800 standard. Inlet threads shall be either AWWA or iron pipe style.

5. Curb Stops: Curb stop shall be the ball valve type with a padlock wing. The valves internal components shall be removable from the top of the valve body. The Curb Stops shall be designed to receive the service pipe connection with straight coupling nut on the street side and on iron pipe thread connection on the opposite side

6. Dual Check Valve. An in-line dual check valve with independent acting checks shall be used downstream of the water meter. The check valve shall have a meter-coupling inlet and shall be contained inside the box. The internal parts of the check valve shall be removable without disconnecting the check valve or the outlet piping.

7. Meter Yoke. The yoke shall include a threaded expansion wheel on the inlet side to the water meter and a smooth machined brass surface on the outlet side to compress a meter washer into the dual check inlet rated for 250 PSI; tightening lugs shall extend from the wheel to allow easy access

8. Meter Boxes for 5/8-inch services shall be of round style and made of Polyvinyl Chloride Plastic with a minimum wall thickness of 0.375 inches. The box shall be sized to accept a 5/8 and ¾-inch water meters and shall have a minimum inside diameter of 18 inches

with a 30-inch depth. The box shall have a non-locking cast iron lid. Lid & box must comply with the requirements depicted in standard detail 7.01.

9. Meter boxes for 1-inch 1-1/2 & 2-inch service: Shall be a galvanized steel vault and conform to the City of Asheville Standard Details for the corresponding meter size. Piping shall be constructed from brass and copper tubing and shall be equipped with a manufactured setter assembly with a lockable angled check valve outlets and by-pass lockable flanged valve or by-pass lockable flanged ball valve inlets.

10. Meter Vaults for Meters 3-inch and Larger: Meters shall conform to the City of Asheville Standard Details for 3-inch and larger meters. These vaults are constructed by a Licensed Utility Contractor for the Owner/Developer for the approval by the Water Engineering Division.

    Meter Vaults shall be located off the street right of way and outside of travel areas. The access door shall be aluminum with a flush drop lift handle, stainless steel hinges and bolts, a stainless steel slam lock, an automatic hold open arm, and compression springs to allow for easy opening. All vaults shall be provided with remote reading capabilities compatible with City meter reading equipment as per the applicable detail.

    A drain to atmosphere shall be provided dedicated solely to draining water from the pit. The drain to daylight shall be minimum 6-inch diameter pipe; as an alternate, the outlet may discharge to a drainage structure at a minimum of 6 inches from the bottom of the structure. All drain outlets shall be provided with a flapper valve. In the event that no practical discharge point is available, a sump pump may be used subject to the Water Engineering Division approval. The owner shall be responsible for providing power to the sump pump and all utility costs associated with its continuous operation. The pump may be located in an outside 'well' or manhole, or in the vault for the backflow prevention assembly, and shall be maintained by the owner. Sump pumps are not allowed to be installed within the water meter vault.

See the Water Service Connections Technical Specifications for more information regarding standard components of new water service connections, and the Approved Manufacturers Products List.

W7 BACKFLOW PREVENTION

A. General

Backflow prevention assemblies are required on all water service connections with the exception of single family or duplex residential units. The type of backflow prevention assembly required is determined by the degree of hazard of the water customer. See the Cross Connection Control Policy for determination of degree of hazard and specific backflow

requirements. The approved waterline extension plans shall clearly indicate which type of backflow prevention assembly is required.

Backflow prevention assemblies shall be installed, tested, and maintained by the customer as required by the Cross Connection Control Policy. Where normal operating pressures exceed 175 psi, a pressure reducing valve shall be installed upstream of required backflow prevention assemblies. This pressure reducing valve shall be owned and maintained by the customer.

The backflow assembly shall be tested for proper operation at the time of installation and annually thereafter in accordance to the Cross Connection Control Policy.

Backflow assemblies with detector by-pass lines shall include a backflow prevention assembly of the same type as the larger, based on hazard classification and manufacturer.

All backflow prevention installations on fire lines, except Reduced Pressure Principle Assemblies, require execution of a Sprinkler System Certification to be submitted prior to testing of the assembly and final inspection.

B. Location of Assembly

The required backflow prevention assembly shall be installed on the plumbing line on the customer's side of the water meter and before any branching of waterline occurs. The backflow prevention assembly shall be installed in a pit or in an above-ground heated insulated enclosure, depending on device type. Backflow prevention assemblies shall be installed within 15 feet of the meter box or adjacent to the right-of-way line for non metered service lines. In special cases the backflow assembly can be located greater than 15 feet from the meter or right-of-way line or inside a building as outlined in the Cross Connection Control Policy. Water Resources Department must grant a variance for alternate location of the device and at a minimum the Developer is required to provide a properly executed Estoppel Certificate, provided by Water Resources Department that outlines the conditions for variance.

C. Installation Requirements

For assemblies installed in a below ground vault, double check backflow assemblies only, a minimum of 12 inches of free clearance or separation shall be provided on all sides and between the bottom of the vault and the lowest point of the backflow assembly.

In addition, a drain to atmosphere shall be provided dedicated solely to draining water from the pit. The drain to daylight shall be minimum 6-inch diameter pipe; as an alternate, the outlet may discharge to a drainage structure at a minimum of 6 inches from the bottom of the structure. All drain outlets shall be provided with a flapper valve. In the event that no practical discharge point is available, a sump pump may be used subject to the Water Engineering Division approval. The owner shall be responsible for providing power to the sump pump and all utility costs associated with its continuous operation. The pump may be

located in an outside 'well' or manhole, or in the vault for the backflow prevention assembly, and shall be maintained by the owner.

Reduced pressure zone backflow assemblies are required to be installed in above ground enclosures or rooms (within a building), and must also be provided with a drain and protected from freezing. The top of the drain shall be located a minimum of 1 inch or two times the size of the relief outlet, whichever is greater, directly below the relief port of the assembly. The drain pipe shall be a minimum of 2 inches in diameter or two times the size of the relief outlet, whichever is greater. A minimum of 12 inches of free clearance or separation shall be provided between the floor slab and the lowest point of the backflow assembly.

See the City of Asheville Standard Details for Above, Below and Inside Building Backflows/Enclosures, for additional details of backflow assembly installations.

Figure W07-a: General Guidelines for Backflow Location and Installation

Degree of Hazard	Type of Service	Type of Backflow Prevention Device	Size of Device	Location Requirements	Installation Requirements
Moderate	Domestic	Double Check Assembly	5/8" to 2"	Within 15 feet of the water meter.	Below ground in a large meter box or above ground heated insulated enclosure.
Moderate	Domestic	Double Check Assembly	2 ½" & above	Within 15 feet of the water meter.	Below ground in a precast drainable pit or above ground heated insulated enclosure.
High	Domestic/ Irrigation	Reduced Pressure Zone Assembly	5/8" & above	Within 15 feet of the water meter.	Above ground insulated enclosure only. Horizontal installation only.
Moderate	Fire (un-metered)	Double Check Detector Assembly	2" & above	Adjacent to road right-of-way.	Below ground in a precast drainable pit or above ground heated insulated enclosure.
Moderate	Fire (metered)	Double Check Assembly	2" & above	Within 15 feet of the water meter.	Below ground in a precast drainable pit or above ground heated insulated enclosure.
High	Fire (un-metered)	Reduced Pressure Zone Detector Assembly	2" & above	Adjacent to road right-of-way.	Above ground heated insulated enclosure only. Horizontal installation only.
High	Fire (metered)	Reduced Pressure Zone Assembly	2" & above	Within 15 feet of the water meter.	Above ground heated insulated enclosure only. Horizontal installation only.

W8 WATER BOOSTER PUMP STATIONS

A. General

Where required to provide minimum flow and pressure requirements, water booster pumping stations shall be constructed in accordance with the Technical Specification for Package Water Booster Pumping Station for City of Asheville ownership and maintenance.

All new water system extensions requiring a booster pumping station will require payment of a "Pump Station Maintenance Fee" prior to granting final plan approval. The amount of the

maintenance fee shall be as specified by the Director. The Engineer of Record shall provide a cost schedule for the pump station including all components, back-up power generator, skid equipment, SCADA, fencing, utilities, etc.

Except as specifically approved otherwise in writing by Director, pumping units shall not cause drop in suction pressures greater than 20 PSI between operating and stopped condition, increase the discharge pressures greater than 25 PSI between operating and stopped condition, and shall not cause service pressure at any meter in water distribution system under peak demand conditions to drop below 40 PSI or increase above 200 PSI under static condition.

Guidelines used by the Water Resources Department in developing these requirements include the following: (1) each pump flow rate shall be capable of filling the associated storage reservoir with maximum pumping cycle of 8 hours per day (2) satisfy peak demand projections with minimum 40 PSI residual at all points in the Water Distribution System; (3) satisfy projected average day demand coincident with fire flow demand with minimum 20 PSI residual at all points in the Water Distribution System, with 25% of the reservoir volume conserved at the end of the fire demand period if the reservoir was full when the fire demand began; (4) maximum residual static pressure at any point in the Water Distribution System not in excess of 175 PSI with booster pump off, and no increase in pressure beyond 25 PSI at any point between pump on and pump off condition; and (5) calculated complete water turnover in the boosted area of the Water Distribution System at 85% of build-out within 5 calendar days or less under average day demand conditions.

B. Pump Design

The Engineer of record shall determine the pumping capacity and a total dynamic head of the pumping units based on the specific elevation requirements, storage availability, pipe head loss calculations, acceptable pressure range for all customer service connections, average demand with fire flow required, peak demand and maximum tank filling pumping cycle as specified above. Calculations shall be submitted as required in the section in this manual for DESIGN REPORT under procedures for extending water system and obtaining service.

C. Building or Enclosure

1. Pump station shall be designed for ground level entry to pumping units, internal piping and accessories, and electrical switch-gear and controls, through a standard doorway. Access designed for confined space entry will not be acceptable. Building or enclosure shall be a low maintenance material such as brick veneer, concrete, decorative concrete or masonry block.

2. Overhead beam and crane shall be provided if weight of pump assembly exceeds 150 pounds.

3. Factory built package units meeting the requirements of the Technical Specification for Package Water Booster Pumping Station are required by these Standards.

4. Exterior architectural features and landscaping may be designed to "fit into" the theme of surrounding properties, subject to this Manual and approval by the Water Resources Department.

D. Site Improvements/Access

An all weather roadway access, at least 12 feet in width, with a grade of no more than 15% shall be provided for all booster pumping station and ground water storage tank sites. At a minimum, said road access shall be designed to provide minimum horizontal radii of 40 feet and no less than 8 inches of compacted aggregate base (CABC) as a riding surface. Larger radii and bituminous concrete asphalt riding surface will be required for slopes exceeding 12%. Adequate road drainage shall be included to protect the integrity of the access roadway.

Site improvements shall be such to provide a clearance of between 8 to 10 feet between the building and other site features. In addition, sufficient parking area shall be provided to allow parking and maneuvering of a heavy duty utility pick up truck completely off the main access road. Landscaping shall be in compliance with the City of Asheville ordinances and requirements, and shall incorporate low maintenance concepts to the greatest extent possible.

Security fencing 6 feet high with additional minimum three barbed wire strands and double leaf gate access, dead bolt door locks, or equivalent access security shall be provided. Fence location shall be such to prevent intrusion to site and any liability associated with potential falls within sites located adjacent to steep cut slopes. Fencing will be required all around the property to be deeded to the City of Asheville, unless topographic site conditions make it unfeasible to comply with this requirement. In these cases, fencing requirements will be determined on a case by case basis.

E. Equipment Components

Refer to the Technical Specification for Package Water Booster Pumping Station, for pump and equipment components.

F. Emergency Accessories

Standard fire hydrants shall be installed immediately outside of pump station on both suction and discharge side of pumps, not to exceed 20 feet apart, to permit portable pump to hook up for alternate pumping in the event of an emergency. Hydrants shall be aligned respectively on the suction and discharge sides of the pump station at accessible locations to street or driveway.

G. Electrical Power Service

Power must be three phase at the required voltage for the pumps. In those areas where 3-phase power extension is deemed to be economically unfeasible, as evidenced by a quote from the power company and determined by the Water Resources Department, variable frequency drives (VFD's) can be utilized in lieu of 3-phase power for motors less than 10 hp. The use of Roto phase converters is not acceptable.

H. Back-up Power Supply

A Natural Gas or Propane powered, commercial heavy duty generator, sized to operate all electrical needs of the booster pumping station, shall be provided as back-up power supply for every pumping station. The generator is to be liquid cooled and is to conform to the Approved Manufacturers Products List for generators. The propane tank capacity shall be no less than 7 day supply for normal operation of the pumping station, rounded to the nearest available commercial capacity. If natural gas is available within 500 feet of the developing property's limits, the gas line shall be extended to supply the back-up generator.

I. Operation and Maintenance Manuals

When construction of a Water Distribution System extension includes the construction of a booster pump station, water storage reservoir, and/or pump station instrumentation, the developer shall submit prior to receiving a Letter of Acceptance from the Water Engineering Division 3 copies of thorough operation and maintenance data on the pumps and appurtenances, reservoir, instruments, PLC/RTU and appurtenances, schematic and ladder diagrams of all programmable controls and as-built panel drawings in hard copy and digital AutoCAD format.

W9 WATER STORAGE RESERVOIRS

A. General

Water pumping stations shall pump to atmospheric ground level water storage reservoirs unless approved otherwise by the Director. Storage tank capacity for residential subdivisions shall be 30,000 gallons plus domestic demand equal to 1 day storage, estimated at 400 gallons per day per dwelling. Additional storage volume may be required for other type of developments in accordance with the North Carolina Fire Prevention Code, local fire department regulations and as otherwise required by the Director.

Ground level water storage reservoirs must be cited on the highest available suitable ground such that at all connections to the Water Distribution System served by gravity from the reservoir maintain a residual water pressure under peak demand conditions of 40 PSI or greater and 20 PSI minimum under fire flow conditions with the water level at half the capacity of the reservoir. The City will not assume any responsibility to provide domestic and/or fire protection services above the maximum hydraulic grade line of the new pump/tank system.

See the Glass-Coated, Bolted-Steel Potable Water Storage Tank and the Prestressed Concrete Storage Tank Technical Specifications for more detailed reservoir specifications.

1. Materials: All ground level water storage reservoirs shall be circular pre-stressed concrete water storage reservoirs meeting all specifications of AWWA Standard D110, latest edition, or glass-fused –to steel, lap sealed joint, bolted steel tanks with aluminum geodesic dome roofs or clear-span and self-supporting radially sectioned roof (rolled knuckle design) fabricated from glass-coated, bolted steel panels. Tanks must be compliant with the requirements of AWWA D 103, D-104 NSF, ISO 9001 and be FM approved.

   All reservoirs shall be structurally designed to meet all requirements of the appropriate AWWA Standard and shall be sealed by a Registered Professional Engineer experienced in structural design.

2. Access and Site Improvements: All weather access roads shall be provided to all storage reservoir locations. Reservoir access roads shall have a minimum width of 12 feet and a maximum slope of 15%. At a minimum, said road access shall have a horizontal radii of 40 feet and no less than 8-inches of compacted aggregate base (CABC) as a riding surface. Larger radii and bituminous concrete asphalt riding surface will be required for slopes exceeding 12%. Adequate road drainage shall be included to protect the integrity of the access roadway.

   Site improvements shall be such to provide a clearance of a minimum 10 feet all around the storage tank. In addition, sufficient parking area shall be provided to allow parking and maneuvering of at least one heavy duty utility pick up truck completely off the main access road. Landscaping shall be in compliance with the City of Asheville ordinances and requirements, and shall incorporate low maintenance concepts to the greatest extent possible.

3. Site fencing: Security fencing 6 feet high with additional minimum three barbed wire strands and double leaf gate access, dead bolt door locks, or equivalent access security shall be provided.

B. Tank accessories:

1. Overflow: An overflow pipe, sized to prevent water levels inside the reservoir from exceeding 6" above the overflow lip in the event the supplying pump fails to cut off under zero service demand conditions, shall be secured on the interior to the tank shell with suitable brackets at appropriate intervals. The top lip of the overflow piping shall be set at the elevation intended for full reservoir storage. Pipe shall be steel with flanged connections for diameter 4 inches or greater and threaded connections for smaller than 4 inches. The end of the overflow pipe shall be covered with a flap valve and shall discharge over a drainage inlet structure or a splash block. Disposal of the chlorinated solution during overflow shall comply with all federal, state, and local regulations. Approved Energy dissipaters shall be installed at all discharge point, away from developed areas, and shall be properly sized to ensure that overflow is released at a non-erosive velocity.

2. Ultrasonic Level Sensor and Transducer: A tank level transmitter will be provided. Please see the SCADA Instrumentation & Control Technical Specifications. The sensor shall read the entire span of the tank in feet of water. The mounting location for the transducer must be reachable from the tank ladder landing area, and be a minimum of 90 degrees from the end of fill line location.

3. Sampling Station: A sampling station shall be provided on the draw line for every water storage tank. The sampling station shall be similar to a standard single meter service and shall include a standard ¾" service saddle, corporation stop, ¾" copper pipe and ball valve. The ball valve and the terminus of the copper pipe shall be housed within a standard water meter box with lid.

W10 SCADA INSTRUMENTATION:

A. General:

SCADA systems shall be provided for the remote operation and monitoring of pumping stations, water storage reservoirs, control valves, pressure regulating or reducing valves and flow monitoring stations. The control system will utilize a **SCADA Control Panel (RTU)** in connection with a **Communication Control Panel**. Data will be communicated via leased telephone lines to and from the North Fork Water Treatment Plant.

Refer to the SCADA Instrumentation & Control Technical Specifications for details and requirements of the instrumentation control system.