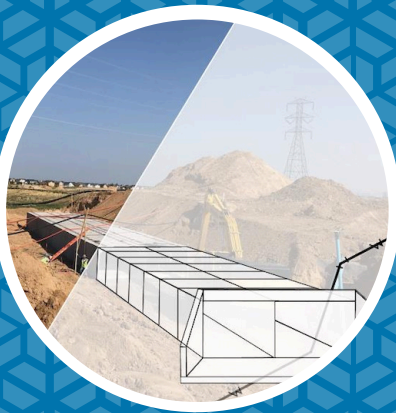




AURORA  
WATER

# **Water, Sanitary Sewer & Storm Drainage Infrastructure Standards & Specifications**



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**Appendix A – Details**

**Appendix B – Approved Materials List**

**Appendix C – Rules and Regulations Regarding Wastewater Control**

**Appendix D – Irrigation System Standards and Inspections**

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# **2020 Summary of Revisions and Changes**

## **Water, Sanitary Sewer, Storm Drainage Infrastructure Standards and Specifications**

### **Section 1.00 Introduction**

#### **1.06 Regional Infrastructure**

- Minor text edits.

#### **1.08.3 Definitions**

- Added City Engineer Definition.

### **Section 2.00 General Provisions**

#### **2.05 Traffic Control**

- Added the sentence “Control Plans shall be submitted to Traffic Engineering through the Permit Center process for review and approval at least five (5) days before start of work.

#### **2.06 Utilities Coordination**

- Minor text edits.

### **Section 3.00 Permits, Extension Agreements, Inspections and Acceptance of Work**

#### **3.01 Public Extension Agreements and Permits**

##### **3.01.2**

- Minor text edits.
- The following sentence was added “Initial acceptance will not be issued until payment is made”.

#### **3.02 Private Extension Permits**

##### **3.02.2**

- Minor text edits.
- Added the line “And payment of all applicable fees”.

#### **3.03 Utility Main Construction (Water Distribution, Sanitary Sewer, and Storm Sewer)**

##### **3.03.1**

- Minor text edits.

##### **3.03.2**

- Minor text edits.

#### **3.03.4**

- Updated Standards and Specs manual link.

#### **3.04**

- Removed verbiage discussing Water stub out fee.
- Updated verbiage to state 3" meters require 4" taps. There will not be 3" taps.

#### **3.03.5**

- Minor text edits.
- Added the line "Aurora water will not issue initial acceptance until the".

#### **3.04 Water services**

- Minor text edits.

#### **3.04.4**

- Minor text edits.

#### **3.06 Construction Inspections**

- Minor text edits.
- Clarified that Storm Sewers also require visual inspection, deflection and air testing.

### **Section 4.00 Job Site Safety, Health and Environmental Requirements**

#### **4.07 Abatement of Air Pollution**

- Added the line "Concrete or sawcutting".

### **Section 5.00 Utility Design Criteria and Construction Plans**

#### **5.02 Water Distribution Lines Design Criteria**

- Minor text edits.

#### **5.02.2 Main Size**

- Removed Twelve inch (12") diameter feeder lines shall be spaced between transmission lines with a maximum distance of three thousand (3,000) feet apart and looped to provide water from more than one (1) source.

#### **5.02.5 Sampling Stations**

- Changes "Engineering at a frequency of one per 1,280 people or one per 400 single family households" to "as determined by Aurora Water Engineering".

#### **5.03.4**

- Changed "For depths greater than twenty feet (20'), the engineer must show that the maximum long-term deflection for the soil condition must not exceed five percent (5%) with SDR-35" to "Engineer shall use a pipe stiffness greater than forty-six (46) psi for depths greater than twenty feet (20')."

#### **5.04 Alignment, Depth and Easements**

- Added the line “and no closer than ten feet (10') horizontally from sanitary sewer when measured from edge to edge. Large diameter mains may require greater separation”.
- Minor text edits.
- This may include concrete or steel encasement of the sanitary sewer main for a length of ten feet (10') on both sides of the crossing (for a total length of 20 feet) at the direction of Aurora Water Engineering
- Added the line “Drainage easements are required for private storm water systems and utility easements must be provided for storm water systems that are owned and maintained by the Aurora Water”.
- Added the line “\*Two parallel public utilities shall be provided twenty-six feet (26'') width minimum easement.”
- Added the line “No trees are allowed in public utility easement or within eight feet (8') of a public utility”.
- For all commercial and multi-family sites, Total Building Surface Area = \_\_\_\_\_ S.F.  
Total Hard Surface = \_\_\_\_\_ S.F. per building.

#### **5.05 Civil Construction Plan requirements**

- Minor text edits.

##### **5.05.1 Standard Notes**

- Minor text edits.
- Added the line “or Upstream of a dead end manhole”.
- Fire service lines without chemical feed systems require at least a double check backflow assembly. All other fire lines, commercial, multi-family and master metered single family residential water service lines require a reduced pressure backflow assembly. Contractors are required to contact Aurora Water to schedule a backflow assembly inspection prior to the issuance of a certificate of occupancy.
- Changed the one day notice required for inspections to two (2) days.
- For all commercial and multi-family sites, Total Building Surface Area = \_\_\_\_\_ S.F.  
Total Hard Surface = \_\_\_\_\_ S.F. per building.

##### **5.05.2 Resistivity Tests**

- Minor text edits.

##### **5.05.3 Water Services**

- Minor text edits.

##### **5.05.4 Fire Suppression Lines**

- Minor text edits.
- Other than the ninety degree (90°) vertical bend in the fire service line at the building riser, fire service lines may have one ninety degree (90°) bend, or more than one (1) bend when the sum of all bends does not exceed ninety degrees (90°), in the length of line from the water main tee to the riser. Submission of a revised civil drawing is required if the sum of all bends exceeds more than ninety degrees (90°).

#### **5.05.5 Storm Water Management Infrastructure**

- Moved to before table in 5.01

#### **5.06 Manhole Spacing**

- Included maintenance access design requirements consistent with the Storm Drainage Design and Technical Criteria Manual.

#### **5.07 Manhole Barrel Size**

- Minor text updates.

#### **5.09 Storm water Inspection and Maintenance Plans**

- Minor text edits.

#### **5.10 Cad Files**

- Add this section.

#### **5.11 Record Drawings**

- Add this section.

### **Section 6.00 Protection of Existing Facilities**

#### **6.02 Concrete Work**

- Minor text edits.

#### **6.03 Pavement Replacement**

- Minor text edits.

### **Section 7.00 Material Handling and Storage**

#### **7.03 Material Storage**

- Added the line "Pipe ends shall be capped while in storage at all times".

### **Section 8.00 Excavation**

#### **8.01 General**

- Minor text edits.

#### **8.02 Trench Evacuation**

- Minor text edits.

#### **8.03 Trench Side Walls**

- Minor text edits.

#### **8.07 Pavement Removal**

- Minor text edits.

#### **8.08 Unstable Trench Conditions**

##### **8.08.1 Unstable Trench Conditions**



- States that a six inch (6") minimum layer of stabilization materials or concrete cradle is required when unstable foundation materials.

#### **8.08.2 Stabilization Material**

- Removes the eight (8) mil polyethylene option for granular bedding material.
- Added "Stabilization Material" to the table.

### **Section 9.00 Pipe Bedding, Backfilling and Compaction**

#### **9.01 General**

- Minor text edits.

#### **9.03 Compacting Granular Bedding**

- Minor text edits.

#### **9.04 Compaction of Ordinary Backfill Material within the Bedding Section**

- Minor text edits.

#### **9.05 Classes of Bedding (Methods)**

##### **9.05.2 Class B Bedding**

- Minor text edits.

##### **9.05.3 Class B Alternate Bedding**

- The same requirements shall apply as in Class B bedding but granular material shall be placed to a depth of one foot (1') above the pipe for all Sanitary Sewer PVC, flexible Storm Sewer pipe installations and all water main pipe. This method may also be used at the Contractor's option or shall be required by the Inspector if the Contractor cannot meet the compaction requirements using ordinary backfill material to one foot (1') above the pipe".

##### **9.05.5 Class D Bedding**

- Section removed.

#### **9.08 Compaction Testing**

- Minor text edits.

#### **9.10 Construction Site Restoration**

- Minor text edits.

### **Section 10 Manholes, Vaults and Inlets**

#### **10.01 Materials**

##### **10.01.3 Precast manholes and vaults**

- Added storm sewer inverts to the list of items not allowed in public sanitary storm or sewer systems without approval.
- Added verbiage requiring 6" of compacted crushed rock under precast manhole and vault bases.
- Minor text edits.

#### **10.01.4 Cast in place Manholes**

- Removed “but does not apply to which may include the shaping of the channel and benches” and “However, vaults may be cast in place to final grade”.

#### **10.01.5 Cast in Place vaults**

- Minor text edits.

#### **10.01.07 Concrete**

- Minor text edits.

#### **10.01.08 Manhole Steps**

- Changed sanitary sewer manholes, storm sewer manholes, and storm sewer inlets and vaults to require manhole steps.

#### **10.01.9 Frames and Covers**

- Updated the Storm Sewer section of the Frame and Covers table.
- Minor text edits.

#### **10.01.10 Flexible Joint sealing Compound**

- Minor text edits.

#### **10.01.12 Hydrogen Sulfide Resistance**

- Changed the minimum thickness from sixty (60) mils to manufacturer’s recommendation.

#### **10.02 Construction**

- Added the line “Manhole bases shall be installed level and if necessary through the use of bedding material or leveling course”.
- Clarifies that only the minimum clearance from any block-out or core drilled opening to the top of a barrel section is three inches (3”) without special design.
- Minor text changes.
- Changed the internal diameter of all manholes from the manhole base from a distance of five feet (5') or less to finished grades.
- Manhole rings no longer require placement of mortar on the fillet. Paragraph has been removed.

#### **10.03 Manhole Bases and Channels**

- Minor text edits.

#### **10.04 Horizontal Joints**

- Minor text edits.

### **10.05 Existing Manholes**

- Minor text edits.

### **10.06 Water System Manholes and Vaults**

- Minor text edits.

### **10.07 Sanitary Sewer System Manholes**

- Minor text edits.

### **10.08 Storm Sewer System Manhole and Inlets**

- Added the line “Pre-cast inlets for public storm sewer systems are not allowed without prior authorization.”.

### **10.09 Reference Markers**

- Minor text edits.

## **Section 11 Water Pipe Installation**

### **11.03 Alignment**

- Removed “Joint Deflections are not allowed on PVC Pipe”.

### **11.04 Excavation, Bedding, and Backfilling**

- Changed the section to read “Excavation, bedding and backfilling shall be according to these specifications.”

### **11.06 Wet Taps**

- Minor text edits.
- Changed the evacuation area for Bolt on saddles to a seven feet (7') minimum on the wet tap side and a minimum of five feet (5') width.
- Notification has changed from 24 hours to 48 hours.

### **11.08 Cradles and Encasements for utility Crossings**

- Minor text edits.

#### **11.08.1 Storm Sewer Crossing over Water or Sanitary Sewer**

- Minor text edits.

#### **11.08.2 Water Crossing over Sanitary Sewer**

- Minor text edits.

### **11.09 Thrust Restraint**

- Minor text edits.

### **11.10 Thrust Blocks**

- Minor text edits.

### **11.11 Cathodic Protection**

- Minor text edits.

### **11.12 Disinfection of Water Lines**

- Added the line “A maximum of three (3) tests are allowed to be performed on any section of main. Upon the third failing test, the pipe is required to be cleaned by a mechanical means. The Aurora Water Department reserves the right to require removal and replacement of the pipe in the event of continued failing test results”.

#### **11.12.5 Slug Method**

##### **11.12.5.2 Flushing the Line**

- Added the line “Through the use of de-chlorination devices”.

#### **11.12.6 Special Conditions**

- Minor text edits.

#### **11.12.7 Bacteria Test**

- Added the line “the Aurora Water Department reserves the right to require and replacement of the water line”.

### **11.14 Pressure Test**

- Steel line pressure tests now defer to AWWA M11 Standards for allowable leakage.

## **Section 12 Ductile Iron (DIP) Water Line**

### **12.03.1 Thickness Class Design of Pipe**

- Section has been added referencing the minimum wall thickness for DIP based on pipe diameter.

### **12.07.4 Push-on Restrained Joints**

- Section has been added to reference allowable restrained push-on joints and the standard they shall conform to.

### **12.09 Cathodic Protection**

- Minor text edits.
- V-Bio is now required as an enhanced polyethylene wrap for pipe.

### **12.10 Installation**

#### **12.10.1 Trench Width**

- Minor text edits.

## **Section 13 Steel Water Line**

### **13.06 Lining**

- Minor text edits.

### **13.08 Mechanically Coupled Joints**

- Minor text edits.

### **13.09 Installation**

#### **13.09.1 Trench Width**

- Minor text edits.

#### **13.09.2 Bedding**

- Minor text edits.

### **13.10 Cathodic Protection**

- Minor text edits.

## **Section 14 Polyvinyl Chloride (PVC) Water Line**

### **14.03 Fittings and Specials**

- Minor text edits.

### **14.07 Installation**

- Joints are allowed to be deflected with the approval of Aurora Water Engineering, provided that the deflections do not exceed manufacturer's recommendations.
- Standard note added stating "All Water lines must be installed with Marker system for locating purposes. Spigot shall not be inserted into the bell past the home line indicated on the spigot or the installation will be rejected."

#### **14.07.1 Trench Width**

- Added the line "the outside diameter of the pipe plus three feet (3)".

#### **14.07.2 Bedding**

- Minor text edits.

## **Section 15 Waterline Valves**

### **15.01 General**

- Minor text edits.

### **15.03 Gate valves**

- Minor text edits.
- Removed the line "For gate valves allowed for use within the City of Aurora see Appendix B: Approved Materials List."
- 16" Gate valves are allowed with the approval of Aurora Water Engineering.

### **15.04 Butterfly Values**

- Minor text edits.
- Removed the line "Refer to Appendix B: Approved Materials List for the models approved for use in the City of Aurora".
- Added "Aurora Water reserves the right to witness bench testing".

### **15.05 Pressure Reducing and Regulating Valves**

- Removed the line "Refer to Appendix B: Approved Materials List for the models approved for use in the City of Aurora".

### **15.06 Check Valves**

- Minor text edits.
- Gate valves can now be located outside of the vault.
- Removed the line “as specified in Section 10.00 of these specifications. See Appendix B, Approved Material List, for approved valves.

### **15.07 Air and Vacuum Valves**

- Minor text edits.
- Clearance has been updated measuring 6 feet from bottom of lid to top of pipe (Per operations).

### **15.08 Blow off Valves**

- Minor text edits.
- Establishes a six inch (6”) minimum for blow off assemblies.

### **15.09 Valve Boxes**

- Minor text edits.

### **15.10 Valve Vaults**

- Minor text edits.

### **15.11 Reference Markers**

- Minor text edits.

## **Section 16 Fire Hydrants**

### **16.02 Hydrant Details**

#### **16.02.2 Color**

- Clarifies that the color of the hydrant is safety yellow.
- Added hydrant colors for raw (Olive Green) and reuse (purple) water.

#### **16.02.03 Coatings**

- Minor text edits.

### **16.03 Installation**

#### **16.03.1 Hydrant Grading**

- Minor text edits.

#### **16.03.3 Traffic Safety Flange**

- Added the line “up to a maximum of eighteen inches (18”) in height”.

#### **16.03.4 Grade Staking**

- Removed the line “Fire hydrants shall be installed according to Standard Detail #208”.

#### **16.03.5 Hydrant Laterals**

- Minor text edits.

#### **16.04 Testing**

- Minor text edits.

#### **16.05 Fire Hydrant Location**

- Minor text edits.

#### **16.05.6 Valley Pans or V-Section Streets**

- Minor text edits.

### **Section 17 Water Service Lines**

#### **17.02 Location and Alignment of Service**

- The title was changed to “Location and Alignment of Service”.

#### **17.03 Materials**

##### **17.03.1 Pipe**

- Minor text edits.

##### **17.03.2**

- Minor text edits.

#### **17.04 Crossing of Sidewalk or Curb (Existing or Proposed)**

- Minor text edits.

#### **17.06 Tapping the main**

- Minor text edits.
- Added the line “and will be reduced after the valve to three inch (3”) diameter”.
- Clarifies that thirty-six inch (36”) separation is required from the nearest bend.

#### **17.07 Service Line Installations**

- Minor text edits.
- Added the line “Grounding to water service line is strictly prohibited”.
- States that all meters require a gate valve at the point of connection.
- Clarifies that all master metered single family attached, commercial, and single family require backflow prevention.

#### **17.08 Meter Pit Installations**

- Minor text edits.

#### **17.09 Multi-Family Meter Installations**

- Clarifies that single family attached developments may be allowed one (1) meter per group of units at the sole discretion of Aurora Water Engineering.
- Minor text edits.

#### **17.11 Discontinuation of Water Service**

- Minor text edits.

## **Section 18 Automatic Fire Suppression Waterline Installation**

### **18.01 Ownership**

- Minor text edits.

### **18.02 New Installation**

- Minor text edits.
- Added the line “when soil resistivity tests indicates resistivity less than one thousand (1,000) ohms”.
- Grounding to fire line is prohibited.

### **18.03 Testing**

- Minor text edits.

### **18.04 Emergency Repairs of Underground Fire Service Mains**

- Removed the line “Emergency impairments shall include, but are not limited to, interruption of water supply frozen or ruptured piping, and equipment failure, and includes impairments found during inspection testing or maintenance activities.
- Minor text edits.
- Replaced the current customer service information with “Please contact: Aurora Water Customer Service to report fire service main breaks, leaks, and issues”.

## **Section 19 Backflow Prevention Assembly**

### **19.01.1 Backflow Prevention Requirements**

- Note added stating that Aurora Water will be reviewing backflow prevention devices.

### **19.04.1 Location and Design**

- All devices must be approved and tested. Critical Facilities may require redundant systems.

### **19.04.6 Reduced Pressure Backflow Preventers**

- Below grade RP backflow devices are not allowed.

### **19.05.2 Reporting, Record-keeping Duties and Requirements**

- Forms are now electronic and tracked online.

## **Section 20 Corrosion Control for Water Pipe**

### **20.01 Soil Resistivity Measurements**

- Minor text edits.

### **20.02 Anode and Testing Site Installation**

#### **20.02.1 Anodes**

- Minor text edits.

#### **20.03.1 Dissimilar Metals**

- Subsection heading has been updated to read Dissimilar Metals and connection to existing Metallic Infrastructure.



- All areas referring to dissimilar metals also has been updated to state dissimilar metals and connections to existing metallic infrastructure.

#### **20.05.2 Polywrap**

- Verbiage added requiring the use of V-bio polyethylene to be used on all DIP and fittings.

### **Section 21 Sanitary Sewer Pipe Installation**

#### **21.01 General**

- Standard note added stating all sanitary lines must be installed with Marker system for locating purposes. This note has been copied to Sections 22 and 23.

#### **21.02 Progression of Work**

- Minor text edits.
- Added the line "Sanitary sewer main shall be installed with class B Alternative".

#### **21.05 Tees, Wyes, and Risers**

- Removed the line "Riser connections may be installed where the elevation of the top of the branch is more than twelve feet (12') below finished ground".
- Removed the line "As built measurements shall be made to the nearest manhole before backfilling".

#### **21.07 Testing and Inspection**

##### **21.07.2 Low-Pressure Air Test**

- Section Added.

##### **21.07.2.1 Air Test Procedure (Dry Conditions)**

- Section Added.

##### **21.07.2.2 Air Test Procedure (Wet Conditions)**

- Section Added.

##### **21.07.3 Deflection Testing**

- Section Added.

##### **21.07.4 Televised Inspection**

- Verbiage added allowing CCTV to be rejected if water is turbulent.
- Verbiage added stating the contractor shall be NASCP PACP certified.

### **Section 22 Polyvinyl Chloride (PVC) Gravity Sewer**

#### **22.01 General**

- Changed the ASTM D3034-SDR35 to D3034-SDR-26.

#### **22.03 Wall Thickness Design of Pipe**

- Changed the ASTM D3034-SDR35 to D3034-SDR-26.

## **22.04 Fittings and Specials**

- Changed the ASTM D3034-SDR35 to D3034-SDR-26.

## **22.07 Markings on Pipe**

- Added the line “All pipe ends shall be capped at the factory prior to being shipped. Pipe arriving onsite without the ends capped shall be rejected. Pipe shall be stored in a way that shall protect the pipe from damage due to exposure to sunlight. Pipe discolored to any extent shall be considered as having sunburn damage and shall be rejected and removed from the project”.
- Added the Deep Sewers, Channel Crossing, Encasement, Casing, and Bores table.

# **Section 23 Sanitary Sewer Service Line Construction**

## **23.02 Materials**

### **23.02.1 PVC Pipe**

- Allows Sanitary Sewer service to also meet ASTM D3034- SDR-26 standards.

## **23.04 Service Line Installations**

- Minor text changes.
- Removed the line “if the water service is installed at least two feet (2') above the sewer service for the entire length of the service laterals”.
- Contractor shall submit CCTV footage to Aurora Water for any trenchless repairs used at the point of connection.

## **23.05 Tapping the main**

### **23.05.1 General**

- Minor text edits.
- Clarified that Inspections will only be scheduled after the applicable fees are paid.
- Removed the line “A manhole shall be installed instead of a saddle tee when a six inch (6”) connection will be made to an existing eight inch (8”) main, or any time the service line is equal to or greater than three quarters the diameter of the main”.

### **23.05.6**

- Replaced paragraph with “Service connections to lined mains where a lining has been installed shall provide an “inserted tee” or approved such that flows do not enter the annulus”.

## **23.06 Clean Outs**

- Minor text edits.

## **23.09 Trench Backfilling**

- Minor text edits.

## **23.10 Inspection**

- Added the line “and after applicable fees are paid. Re-inspection fees may apply to work that does not comply with these specifications.”.

### **23.12 Warranty of Work**

- Removed the line “The owner/Developer shall warrant all work to be free from defects in workmanship or materials for a period of one year from the date of initial acceptance”.
- Minor text edits.
- States the warranty period is one year.

### **23.13 Discontinuation of Sewer Service**

- Added the line “Example: Sanitary Sewer Services that are not utilized at the time of redevelopment must be abandoned at the point of connection to the public main”.
- Minor text edits.

## **Section 24 Underdrain Pipe**

### **24.01 General**

- Removed the line “The underdrain system shall in no case be constructed with sealed joints”.
- Underdrain connections require a license agreement.

### **24.05 Alignment**

- Minor text edits.
- Referenced new detail.

### **24.06 Underdrain Clean Outs**

- Minor text edits.

### **24.07 Underdrain Outfall Locations**

- Section has been added specifying where underdrain systems are approved to outfall.

### **24.08 Installation**

- Section has been added. City’s only responsibility is to verify outfall location matches the approved plan set.

## **Section 25 Storm Sewer Pipe Installation**

### **25.01 General**

- Standard note added stating all storm lines must be installed with Marker system for locating purposes. 3M markers are required for public infrastructure. Tracer wire is optional for private infrastructure. This note has been copied to Sections: 26, 27, 28, 29, and 31.

### **25.02 Approved Pipe Materials**

- Clarifies that Aurora Water reserves the right to require RCP for arterial roadways.

### **25.07 Backfill and Compaction**

- Added the line “The Contactor shall schedule an inspection and submit a closed circuit TV inspection of the main to Aurora Water”.
- Minor text edits. Referenced Section 21.07 for additional testing requirements.

## **Section 26 Reinforced Concrete (RCP) Storm Sewer Pipe**

### **26.01 General**

- Added the line “Aurora Water reserves the right to require RCP in City of Aurora right of way”.

### **26.05 Acceptance of Pipe for Construction**

- Removed the line “having an area of more than ten square inches (10”) and a depth of more than one half inch”.
- Minor text edits.

## **Section 27 Aluminized Steel (ASP) Storm Sewer Pipe**

- No changes were made.

## **Section 28 Polyvinyl Chloride (PVC) Storm Sewer Pipe**

### **28.02 Pipe and Fittings**

- Minimum size of PVC pipe is 18” diameter.

## **Section 29 High Density Polyethylene (HDPE) Storm Sewer Pipe**

- Minor text edits.

## **Section 30 Open Channels and Ponds**

- Minor text changes.

### **30.04.2 Final Acceptance**

- Verbiage updated stating weeds do not qualify as vegetation and 70% of pre-construction vegetative coverage is required.

## **Section 31.00 Polypropylene (PP) Storm Sewer Pipe**

- This section has been added and will be used for public infrastructure on a case by case basis with the approval of Aurora Water.

## **Appendix A - Details**

### **100 Series – General**

#### **100-1 Pipe Bedding Classes**

- Minor Text Change.

#### **100-2 Pipe Bedding Classes**

- Class C and Class D Cross sections have been deleted and replaced with a Private Underdrain Cross Section.
- Underdrain Pipe on Encasements and Unstable Trench cross sections has been removed.

### **101-1 Standard Manholes**

- Graphically added 6" x 6" concrete collar for manholes in landscaped areas.
- Graphically added manhole steps and referenced Detail 105 for additional information.

### **101-2 Manhole Base Detail**

- Note added requiring 6" of crushed rock under precast bases.

### **101-4 Typical Manhole Channels**

- 90 Degree Sweep has been extended to accommodate wider turn.

### **101-5 Pipe Configuration into Manhole**

### **102-1 24" Manhole or Inlet Ring and Cover**

- Note added stating COA Labeling is not to be included on private infrastructure

### **103 30" Manhole Ring and Cover**

- Detail modified to show Sunburst Logo
- Note 4 Modified requiring HS20 loading for Lids

### **104 36" Manhole Ring and Cover**

- 22" Access Lid now shown as offset rather than centered on 36" cover
- Detail modified to show Sunburst Logo

### **105-1 Manhole Step**

- Dimensions updated to match Manufacturers Cut Sheet

### **105-2 Manhole Step**

- Dimensions updated to match Manufacturers Cut Sheet

### **107 Typical Steel Encasement Construction**

- Casing Chocks spacing has changed from 10' to 8' MAX.
- Note 5 has been updated not requiring casings to be polywrapped.

## **200 Series – Water**

### **200 Meter Installation Procedure**

- Contact information has been updated.
- Note below flow chart has been updated requiring the Owner/Developer to adjust the grade of the Pit, Yoke or Lateral as necessary prior to the meter set.

### **201 Meter Installation ¾" and 1" Service**

- Description 1 has been updated requiring Corporation Stop be placed at 10 or 2 O'Clock on the pipe.
- Description 4 has been updated to reference Appendix B for meter pit materials.
- Note 3 has been updated requiring hardscape to be installed prior to Meter set.
- Dimensioning has been updated on bottom detail reflecting 2 FT from hardscape
- Note 6 has been updated requiring the Owner/Developer to adjust the grade of the Pit, Yoke or Lateral as necessary prior to the meter set.
- Note added requiring Jumpers on yokes to be installed at factory.

- Contact Name and Numbers have been updated.

#### **202-1 Meter Pit Cover**

- Note 2 has been updated requiring Composite lids.
- Note 3 has been updated allowing Cast Iron or Composite hoods.
- Note 4 added requiring address tags for clustered pits.

#### **202-2 Meter Pit Cover ¾" and 1"**

- Detail has been replaced with the new AMI Composite Lids.

#### **203-1 Bank Meter Pit Detail (Formerly Multi Meter Vault)**

- Detail has been replaced with new Bank meter pit detail.

#### **203-2 Multi Meter Vault**

- Detail has been deleted.

#### **204-1 1 ½" Disc and 2" Turbine Irrigations Meter Vault Installation**

- Note added requiring that ¾" crushed rock be placed to the top of footing inside the Vault.
- Contact Names and Numbers have been updated.
- Added note 10 requiring that the Curb Stop be located no further than 3 FT outside the vault on the upstream side.
- Added Note 11 Prohibiting Shrubs being planted within 5 FT of Lid.
- Added note 12 Requiring Concrete collars on Curb boxes in landscaped areas.
- Note 11 under materials has been updated referencing Appendix B for Materials.
- Note 12 under Materials has been deleted.

#### **204-2 3", 4", and 6" Turbine Irrigation Meter Vault Installation**

- 6" Service has been added to this detail.
- Contact Names and Numbers have been updated.
- Added note 11 requiring that the Gate Valve be located no further than 3 FT outside the vault on the upstream side.
- Added Note 12 Prohibiting Shrubs being planted within 5 FT of Lid.
- Added note 13 Requiring Concrete collars on Valve boxes in landscaped areas.
- Isolation Gate Valves have been added to the Elevations View.
- Dimensioning has been updated.
- DIP requirement meets Pressure Class 350 with minimum Class 52 thickness.
- Note for Crushed Rock has been updated to state "¾" Crushed Rock shall extend from 4" below footing to top of Brick support".

#### **205 1 1/2" and 2" Disc Meter Custom Setter Installation for Domestic Service**

- Contact Names and Numbers have been updated.
- Added note 8 requiring that the Curb Stop be located no further than 3 FT outside the vault on the upstream side.
- Note for Crushed Rock has been updated to state "¾" Crushed Rock shall extend from 4" below footing to top of Brick support".

- Added Note 9 Prohibiting Shrubs being planted within 5 FT of Lid.
- Added note 10 Requiring Concrete collars on Curb boxes in landscaped areas.

#### **206-1 3", 4", and 6" Compound Meter Vault Installation for Domestic Service**

- 6" Service has been added to this detail.
- Note on plan view added requiring pipe to have mechanical joints and to be fully restrained.
- Numbering corrected and minor text changes made.
- Added note 11 requiring that the Gate Valve be located no further than 3 FT outside the vault on the upstream side.
- Added Note 6 Prohibiting Shrubs being planted within 5 FT of Lid.
- Added note 13 Requiring Concrete collars on Valve boxes in landscaped areas.
- Added Note requiring ¾" Crushed Rock placed 4" thick below vault.

#### **206-2 Composite Meter Pit lid for Compound Meter (Landscape Only)**

- Detail has been added to Accommodate AMI Lids.

#### **206-3 Composite Meter Pit lid for Compound Meter (Hardscape Only)**

- Detail has been added to Accommodate AMI Lids.

#### **207 24" Water Meter Pit Ring and Cover**

- Detail has been modified to incorporate AMI Lids.

#### **208-1 Fire Hydrant Assembly**

- Callout has been revised requiring Blocking to be placed under all hydrant laterals (not only PVC).
- Note 3 Added stating Max bury depth on hydrants is 5'-6".
- Note 4 added stating that any hydrant older than 5 years old must be replaced. Less than 5 years can be relocated.

#### **208-2 Fire Hydrant Bollards**

- Bollard spacing has been revised to 6' MAX spacing.
- Bollard diameter has been updated from 4" to 6".

### **209-1 2" Temporary Blowoff**

- Temporary Blowoff Detail has been removed and subsequent details have been renumbered.

### **209-1 2" Blowoff**

- Graphics and text have been revised requiring main line be reduced to 4" for GV followed by a cap with 2" threaded hole for the Blowoff.
- All brass fittings have been updated to require Galvanized Steel only.
- Note 2 has been added requiring an isolation valve on the mainline where a temporary Blowoff is required.

### **210-1 6" Blowoff for DIP or PVC**

- DIP requirement meets Pressure Class 350 with minimum Class 52 thickness.
- Graphics now depict a 6x12 reducer, Thrust Block, and a 12" Riser Pipe.

### **210-2 6" Blowoff for Steel**

- DIP requirement meets Pressure Class 350 with minimum Class 52 thickness.
- Graphics now depict a 6x12 reducer, Thrust Block, and a 12" Riser Pipe.

### **211-1 2" Air Vacuum Valve Installation**

- Dimension has been updated requiring 6' separation from top of pipe to bottom of vault lid per operations.

### **211-2 2" Air Vacuum Valve Installation**

- Dimension has been updated requiring 6' separation from top of pipe to bottom of vault lid per operations.
- Note revised on detail requiring double strap saddles for corporation taps on PVC and DIP.

### **211-3 Air Vacuum Valve Access Manhole**

- Dimension has been updated requiring 6' separation from top of pipe to bottom of vault lid.

### **212-1 Butterfly Valve Installation**

- Note added requiring  $\frac{3}{4}$ " crushed rock be placed 4" below the vault.
- Field joint has been moved away from the valve to allow for Corporation tap location.

### **212-2 Valve Box Support Plate and Valve Operator Extension Guide**

- Formerly Detail 214 has been relocated and numbered as 212-2.

### **213 Typical PRV or Check Valve Station**

- Plan view has been updated to show 36" Cover with 22" opening to match DTL 104.
- Sump pit is now shown in profile view.
- Added note requiring  $\frac{3}{4}$ " Crushed Rock be placed 4" thick below vault.



**214 Valve Box Support Plate and Valve Operator Extension**

- Detail has been relocated to 212-2. All subsequent details have been renumbered.

**218 Sacrificial Anode Installation**

- Dimensioning updated allowing anode to be placed 5 ft from pipeline.
- Minor text changes.

**219 Reference Post**

- Note updated requiring that marker posts be placed no further than 3 ft (not 5 ft) from the appurtenance.

**220 Thrust Block Location, Bearing Areas and Volumes**

- Minor text changes.

**221 Waterline Lowering Detail**

- Minor text changes.

**222-1 Thrust Block and Restraint for Fire Suppression Lines**

- Tie rods are now shown graphically in the details.
- Note added stating that PVC is allowed with approval based on soil resistivity testing.

**223-2 Thrust Block and Restraint for Fire Suppression Lines**

- Detail has been deleted. Subsequent Details have been renumbered.

**222-2 Thrust Block and Restraint for Fire Suppression Lines**

- Note added stating that PVC is allowed with approval based on soil resistivity testing.
- Callout added stating that all piping shall be restrained.
- Minor text changes.

**223-4 Thrust Block and Restraint for Fire Suppression Lines**

- Detail has been deleted.

**225 Backflow Prevention Typical Installation**

- Callout added requiring a climate controlled hot box.

**228-1 Irrigation System Pressure Type Vacuum Breaker**

- Detail has been deleted and subsequent details have been renumbered.

**228-3 Irrigation System Installation for Continuous Service**

- Detail has been deleted.

**228 Cut-Off Wall for Ditch or Canal Crossing**

- Casing pipe has been graphically depicted on the canal side.

## **229 In-Line Anchor**

- Callout Added stating no pipe joints are allowed between the Anchor and the Cap.

## **230 Sampling Station**

- Detail has been added.

## **300 Series – Sanitary Sewer**

### **300 Sanitary Sewer Service Detail**

- Note 5 requiring service laterals be marked with an S on the curb has been removed.
- Note 7 has been added requiring that Cleanouts be installed for all new services and service repairs.

### **301 Sanitary Sewer Cleanout**

- Note 4 has been added requiring that Cleanouts be installed for all new services and service repairs.

### **302 Private Underdrain Clean-Out Connection**

- Underdrain detail has been updated showing 8" separation between Underdrain and manhole base.
- Additional notes have been added.

## **400 Series – Storm Sewer**

### **400-1 24" Type R Inlet Ring and Cover**

- Detail has been deleted and subsequent details have been renumbered.

### **400-1 Curb Opening Inlet Type R Modified**

- Additional Rebar has been added in Plan View around Inlet opening.
- Note 1 has been updated allowing precast inlets with preauthorization only.
- Note 4 has been removed stating lip of gutter shall not be dipped and top of box shall not be raised.

### **400-8 Special Retrofit Curb Opening inlet Type R Modified**

- Detail has been deleted.

### **400-7 Type R Inlet Greater than 15' Length**

- Minor Text Change.

### **401 Inlet Connection into Storm Sewer Main**

- Minor Text Change.

### **402 Concrete Cradle**

- Minor Text Change.

### **403 Typical Concrete Drainage Pan**

**404 Low Flow Channels**

- Cross section has been updated to slope the channel 2% towards the center.
- Note added for a minimum longitudinal slope of 0.4%.

**405 Roadway Edge Drain Connection to Type R Inlet**

- Detail has been added.

**Appendix B**

- Approved Products List has been updated.

**Appendix C**

- Minor text format updates.

**Appendix D**

- Latest irrigation design standards were added as an Appendix.

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## **SECTION 1.00 INTRODUCTION**

- 1.01 Scope
- 1.02 Authority
- 1.03 Amendments, Revisions and Updates
- 1.04 Review and Approval
- 1.05 Critical Infrastructure
- 1.06 Regional Infrastructure
- 1.07 Interpretation
- 1.08 Definitions and Terms

## **SECTION 1.00 INTRODUCTION**

### **1.01 Scope**

This volume, entitled Standards and Specifications Regarding Water, Sanitary Sewer and Storm Drainage Infrastructure sets forth the minimum acceptable criteria for public and private utilities and facilities within the City of Aurora. Deviations or variances from these standards may be considered; however, it shall be the responsibility of the applicant to demonstrate to the satisfaction of the General Manager of Aurora Water or his authorized representative the proposed variance meets or exceeds the minimum acceptable criteria. See Section 5.01 of these specifications for variance procedures. Any proposed waiver of a City Code provision may only be made according to the procedures set forth in the City Code. Policies and technical criteria not specifically addressed in this document shall follow the provisions of the latest editions of the American Water Works Association (AWWA), American Society of Civil Engineers (ASCE), and Urban Drainage and Flood Control District (UDFCD).

### **1.02 Authority**

Portions of the Aurora City Code most often consulted in this volume include Chapter 138 Articles IV – VII.

### **1.03 Amendments, Revisions and Updates**

Amendments, revisions and updates to these specifications, including Appendix A: Details, Appendix B: Approved Materials List, Appendix C: Rules and Regulations Regarding Wastewater Control, and Appendix D: Irrigation Systems Standards and Specifications may be adopted annually and as often as needed. It is the responsibility of the Consultant/Contractor/Developer/Builder to obtain the latest document(s) from the City. All documents available at [www.auroragov.org](http://www.auroragov.org) shall be considered the latest version.

### **1.04 Review and Approval**

City staff will review all submittals for general compliance with these specifications. However, approval by the City does not relieve the owner, engineer, or designer from the responsibility of insuring their calculations, plans, specifications, construction and as-built drawings are correct and in compliance with these specifications. City of Aurora assumes no responsibility or liability for the accuracy or adequacy of the design submittal.

### **1.05 Critical Infrastructure**

Aurora Water reserves the right to design and install infrastructure which is determined to be critical by the Engineer for the operation or extension of the City's water, sanitary sewer or storm drainage systems.

## 1.06 Regional Infrastructure

Infrastructure determined to be regional infrastructure by the Engineer shall require pre-qualification of Contractors by the City. Regional infrastructure shall include at minimum water mains greater than twelve inches (12") in diameter, sewer lines greater than fifteen inches (15") in diameter, and storm drainage infrastructure as determined by City Code.

## 1.07 Interpretation

In the interpretation and application of the provisions of these specifications, the following shall govern:

- These specifications shall be regarded as the **minimum requirements** needed for the protection of the health, safety, and welfare of the people of Aurora, and shall be liberally construed to further such purposes.
- Whenever these specifications and any other law, ordinance, resolution, rule, or regulation of any kind contain any restrictions covering any of the same subject matter, whichever standards are more restrictive shall govern.
- These specifications shall not abrogate or annul any permits and plans issued and approved, respectively, prior to these standards effective date, or any final plat documents that have been recommended for approval by the Planning Commission prior to the effective date of these standards.

## 1.08 Definitions and Terms

Wherever in these specifications or on the submitted drawings the following terms, acronyms, or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

<b>1.08.1</b>	<b>Associations</b>
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
COA	City of Aurora
FEMA	Federal Emergency Management Association
IBC	International Building Code
IPC	International Plumbing Code
IRC	International Residential Code
ISO	Insurance Service Office, Inc.
NFPA	National Fire Protection Association
TCH	Tri-County Health
UPC	Uniform Plumbing Code
UDFCD	Urban Drainage and Flood Control District
WEF	Water Environment Federation

### **1.08.2 Other Abbreviations**

ACP	Asbestos Cement Pipe
ASP	Aluminized Steel Pipe
BFE	Base Flood Elevation
C & G	Curb and Gutter
CIP	Cast Iron Pipe
COI	Curb Opening Inlet
CSP	Corrugated Steel Pipe
DIP	Ductile Iron Pipe
HDPE	High Density Polyethylene Pipe
MH	Manhole
PCR	Point of Curb Return
PVC	Polyvinyl Chloride Pipe
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
VCP	Vitrified Clay Pipe

### **1.08.3 Definitions**

**Aurora Water/Water Department** shall mean the City of Aurora's utility enterprise responsible for water, sanitary sewer and storm drain infrastructure.

**City** shall mean the City of Aurora, Colorado, a home rule municipal corporation of the counties of Adams, Arapahoe, and Douglas, sometimes acting by and through its Utilities Enterprise.

**City Engineer** shall mean an authorized representative of the City of Aurora Public Works Department.

**City Code** shall mean the duly adopted City Code of the City of Aurora, Colorado, as amended.

**Contractor** shall mean an individual or other person or entity licensed and bonded as a Contractor in the City in accordance with the City Code.

**Engineer** shall mean an authorized representative of Aurora Water Engineering.

**Expressions** Wherever the words, "as directed", "as required", "as permitted", or words of like meaning are used, it shall be understood that the direction, requirements, or permission of Aurora Water Engineering is intended. Similarly, the words "approved", "acceptable", "satisfactory" shall refer to approval by Aurora Water Engineering. Whenever the words "these Specifications" are used it shall be understood that reference is made to Aurora Water's Standards and Specifications Regarding Water, Sanitary Sewer and Storm Drainage Infrastructure including all parts, supplements, and revisions pertaining thereto.



**Public Improvements** include all work in the public right-of-way or in or on City property, easements dedicated to the City, private property that will become City property or an easement to the City in the future, and all other projects or utilities that are or that will become the City's responsibility to maintain.

**Private Construction Work** includes private sewer systems, storm drainage systems, water and sewer service lines to buildings, grading, drainage structures, retaining walls, parking lots, private streets and walks, fire lanes, driveways, and associated construction outside of the public right-of-way.

**Subcontractor** - Any individual or other person or entity licensed and bonded as a contractor in the City in accordance with the City Code which has a direct or indirect contract with the Contractor or other Subcontractor and furnishes and/or performs on-site labor and/or furnishes materials used in connection with the performance of the work.

**Surety** shall mean the entity which bonds and guarantees the Contractor's satisfactory performance of the work as described in these specifications. (Bonded)

**Testing Agency** - Any individual or other person or entity which is qualified and licensed to perform the required sampling, analysis, testing, and professional recommendation service.

**Project Delivery Services Inspector** shall mean the authorized representative of the General Manager of Aurora Water assigned to inspect wet utility infrastructure, heretofore referred to as "Inspector".

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## **SECTION 2.00 GENERAL PROVISIONS**

- 2.01 Authority of the Engineer
- 2.02 Authority of the Inspector
- 2.03 Defective Materials and Work
- 2.04 Inspection Facilities
- 2.05 Traffic Control
- 2.06 Utilities Coordination
- 2.07 Storm Water Quality
- 2.08 Damages
- 2.09 Protests

## **SECTION 2.00 GENERAL PROVISIONS**

The provisions stipulated in this section shall be considered as applicable to all parts of these specifications, including supplements and revisions.

### **2.01 Authority of the Engineer**

The Engineer is designated by the City Manager to exercise all authority on behalf of the City to ascertain all construction of facilities is equal to or better than the minimum construction requirements set forth in these specifications. The Engineer shall be represented by an Inspector who will check any and all work performed under a permit issued for construction, including all materials to be incorporated in the work, excavation, bedding, backfill, and all construction methods and practices. The Engineer shall have the sole authority to issue, in writing, any deviations from the provisions of these specifications or changes to any previously approved drawings.

### **2.02 Authority of the Inspector**

Inspectors are assigned by the Engineer to assist the Contractor in complying with these specifications. Inspectors have the authority to reject inferior materials, defective workmanship and to suspend work which is not in accordance with the City of Aurora Standards and Specifications until such time as the corrections are made and approved.

Once a utility extension agreement has been executed by Aurora Water, a pre-construction meeting must be scheduled at least one week in advance with Project Delivery Services (PDS) Inspections. After a pre-construction meeting is held, PDS Inspections must be notified at least twenty-four (24) hours prior to any construction commencing.

### **2.03 Defective Materials and Work**

Whenever materials and/or work are found to be defective, the Contractor, at his/her expense, shall promptly remove such defective materials and construction from the job site, and replace all defective portions to the satisfaction of the Engineer. In the event the Contractor fails to remove defective items from the job site within ten (10) days of written notice, the Engineer may arrange for such removal at the expense of the Contractor.

### **2.04 Inspection Facilities**

The Contractor shall furnish all reasonable facilities and shall assist the Inspector, as necessary, for the proper inspection of materials to be used and workmanship involved in the construction. The Contractor is responsible for having the latest approved civil plans and extension permits on site at all times.

### **2.05 Traffic Control**

The Contractor is required to implement traffic control per the Roadway Design and Construction Specifications, latest revision. Traffic Control Plans shall be submitted to Traffic Engineering through the Permit Center process for review and approval at least five (5) days before start of work.

## **2.06 Utilities Coordination**

The Contractor shall at all times coordinate his/her work with the Aurora Water Department. When it is necessary to close existing portions of any water or sewer system due to construction operations, prior written notification must be given to the Aurora Water Department for review and approval.

**All water valves that are in service shall be operated only by authorized Aurora Water Department Personnel.**

Unauthorized operations of the water valves are subject to fines under the City Code. The Contractor shall conduct his/her operations in such a manner as to minimize inconvenience to the public due to disconnected utility services. Should it become necessary to temporarily disconnect any utility, the Contractor shall first obtain the approval of the Aurora Water Department. Such utility shall not be disconnected prior to 9:00 a.m. and shall be restored to full operation no later than 4:00 p.m. the same day. If the Contractor's operations require or cause the utility service to be disconnected beyond the limits stated above, he/she shall make arrangements suitable to the (Engineer) to provide temporary utility service or adjust work hours. Such temporary services shall be at the Contractor's expense. In the event a utility is disconnected beyond the hours stated above, the Engineer shall have the authority to order a temporary utility service installed either by City personnel or by a third party at the Contractor's expense.

## **2.07 Storm Water Quality**

The Contractor shall conform to the City of Aurora Rules and Regulations Regarding Stormwater Discharges Associated with Construction Activities latest revision, at all times.

## **2.08 Damages**

The Contractor shall indemnify and hold harmless the City of Aurora, its officers and employees against all suits or actions of any kind and nature brought, or which may be brought, or sustained by any person, firm, or corporation, or persons, firms, or corporations, in connection with, or on account of the Contractor's work; or in consequence of any negligence in connection with same, or on account of any poor workmanship, or on account of any act of commission or omission of the Contractor or his/her, its, or their agent or employees, or for any cause arising during the course of construction.

## **2.09 Protests**

If the Contractor considers any work demanded of him/her by the Inspector to be outside the requirements of these specifications, he/she shall immediately ask for a written decision or instructions from the Inspector and shall proceed to perform the work to conform to the Inspector's ruling. If the Contractor considers such instructions unsatisfactory, he/she shall, within two (2) business days after their receipt, file a written

protest with the Engineer, stating his objections and the reasons therefore. Unless protests or objections are made in the manner specified and within the time limits stated herein, the Contractor hereby waives all grounds for protests.

## **SECTION 3.00 PERMITS, EXTENSION AGREEMENTS, INSPECTIONS AND ACCEPTANCE OF WORK**

- 3.01 Public Extension Agreements and Permits
- 3.02 Private Extension Permits
- 3.03 Utility Main Construction
- 3.04 Water Services
- 3.05 Construction Inspections
- 3.06 Initial Acceptance for Utilities
- 3.07 Warranty Period
- 3.08 Final Acceptance for Utilities

## **SECTION 3.00 PERMITS, EXTENSION, AGREEMENTS, INSPECTIONS AND ACCEPTANCE OF WORK**

### **3.01 Public Extension Agreements and Permits**

**3.01.1** The Aurora Water Department requires a Public Extension Agreement be signed by the owner/developer for all public utility system installation or abandonment. Engineering drawings in accordance with these specifications must be submitted to the City of Aurora Public Works Engineering Services Division for approval. When the drawings have been approved, the Applicant obtains and returns signed agreements to the Water Engineering Division, prior to the issuance of the Utility Permit. The Inspector must be notified at least twenty-four (24) hours in advance of the time construction will begin. The Inspector must be notified and be present when construction commences. A complete set of approved drawings, specifications, and a valid permit shall be on the job site and available to the Inspector at all times.

**3.01.2** When Inspectors or other City personnel are required to work overtime or on legal holidays (New Year's Day, Martin Luther King JR. Day, Presidents Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, the Friday after Thanksgiving Day and Christmas Day) it shall be at the Contractor's expense. Inspectors normally work an eight (8) hour day from 8:00 a.m. to 4:00 p.m. Monday through Friday. Other days or hours shall be considered overtime and shall be paid at the Contractor's expense. A minimum charge of four (4) hours shall be charged for any overtime work requested and performed on weekends and legal holidays. The Contractor's payment for all overtime work shall be made by check to the City of Aurora at the Tap Applications counter at Aurora Municipal Center on the 2<sup>nd</sup> Floor in the Building Permit Center, 15151 East Alameda Parkway, Suite 2400, Aurora, Colorado 80012. The phone number for the Tap Applications Office is 303-739-7395.

**Initial Acceptance will not be issued until payment is made.**

### **3.02 Private Extension Permits**

**3.02.1** Private Extension Permits are required for the repair or construction of any private water service, fire suppression, sanitary sewer service or storm sewer line or appurtenance. Permits shall be obtained before any work is authorized or allowed. Permits shall be issued only to the Contractor who is actually performing the work and is licensed and bonded within the City for the type of work proposed.

**3.02.2** Private Extension Permits are issued only after the City Engineer and the Water Department Engineering Division have approved the plans for the specific improvements to be constructed and all applicable fees have been paid. New construction plans must be reviewed and approved per Public Works Roadway Design and Construction Specifications latest revision. Water Engineering may at its discretion approve plans solely for service connections and fire suppression lines or replacement in kind without approval by the City Engineer. Emergency repairs do not require an approved plan, however still require permitting and payment of all applicable fees.



**3.02.3** A complete set of approved drawings, specifications, and a valid permit shall be on the job site and available to the Inspector at all times.

### **3.03 Utility Main Construction (Water Distribution, Sanitary Sewer and Storm Drainage)**

**3.03.1** ALL PUBLIC AGREEMENTS AND PERMITS, PER SECTION 3.01, ARE REQUIRED PRIOR TO STARTING CONSTRUCTION.

Developers must have a signed Public Extension Agreement, approved drawings, and any inspection fees paid BEFORE Utility Permits can be issued. No work can begin without the Utility Permit. Public Extension Agreement, Utility Permits and approved plans must be on-site at all times.

**3.03.2** An Inspector must be present with a copy of the approved drawings and the Utility Permit when construction first commences. The inspection schedule shall be arranged at the commencement of work. Work done without Inspector approval may be cause to have the work removed and redone. All work must meet the Inspector's approval prior to the Contractor scheduling "Initial Acceptance" inspections. Any deviation from the approved drawings must be approved by Aurora Water Engineering, Life Safety and Public Works Engineering Divisions through the Inspector prior to proceeding with the construction.

**3.03.3** Utility mains shall be grade staked if overlot grading operations have not been completed.

**3.03.4** Construction must be in accordance with these specifications. These specifications are obtainable from the Permit Center at 15151 E. Alameda Parkway, Suite 2400, Aurora, CO 80012 or on-line at [Aurora Water Rules and Regulations Specification](#).

**3.03.5** The backfill must pass compaction tests as specified in the Public Works Roadway Design and Construction Specifications latest edition. Compaction test reports shall be submitted to the City Materials Testing Laboratory for review and approval. Public Works will not issue any pavement permits, where utilities lie beneath the future paving, until the utilities have been Initially Accepted. Aurora Water will not issue Initial Acceptance until the City Materials Testing Lab has approved the testing reports for the subject utility permits.

**3.03.6** A "Notice of Initial Acceptance" is issued to the developer when construction is complete and has passed all testing requirements. See Section 3.06 of these specifications for additional information.

### **3.04 Water Services**

**3.04.1** All permits are required prior to starting construction of water services.

**3.04.2** Prior to setting a water meter, the water service connection, sanitary sewer connection and Metro Wastewater District fees must be paid at the Permit Center at 15151 E. Alameda Parkway, Suite 2400, Aurora, CO 80012.

**3.04.3** Water mains shall have been inspected and initially accepted by the Inspector prior to installation of any service taps on the line.

**3.04.4** The Contractor may proceed with installation of two inch (2") and smaller water taps on the pressurized main only after testing, Initial Acceptance, and payment of the water service connection fee. The Contractor shall supply the corporation stop with service insulator as needed. The Inspector shall inspect the corporation stop and the service line from the main to the building, for all water service taps, prior to the Contractor backfilling the service line trench. The Aurora Water Department shall perform all four inch (4") and larger wet taps on any existing main, after payment of fees and at a prearranged time.

**3.04.5** If any grade changes occur during the initial warranty period, it shall be the owner/Contractor's responsibility to adjust service laterals and meter pits to proper depth or grade according to these specifications. The Contractor shall be responsible for maintenance of the entire line during the period from initial warranty to Final Acceptance. The warranty period shall not be less than one (1) year. The City will be responsible for maintenance of the line from the main to and including the meter only after Final Acceptance has been issued by the City of Aurora. Final acceptance does not occur for water services until the meter is set.

### **3.05 Construction Inspections**

**3.05.1** The Contractor shall obtain the Inspector's approval of any material before placement and before beginning any work.

**3.05.2** The Contractor shall call for all inspections providing a minimum of two (2) business days' prior notice. The Inspection Center can be contacted at 303-739-7385.

**3.05.3** In the event any of the work or material fails to meet any of the requirements of these specifications, written notice of the rejection shall be given to the Contractor and work shall be halted until corrective action is taken.

**3.05.4** Periodic construction observation is only an aid to the Contractor and in no way reflects any responsibility on the part of the City for quality or quantity control, and in no way implies acceptance of the work, or any part thereof, by the City.

**3.05.5** Project Delivery Services (PDS) Inspections personnel will only inspect wet utility piping, appurtenances and backfill. All other inspections (grading, paving, etc.) are required to be inspected by the Public Improvement Inspections Division of Public

Works.

### **3.06 Initial Acceptance for Utilities**

When the final clean-up has been performed, the Contractor shall notify the Inspector all work has been completed and schedule an inspection. The Inspector will perform all necessary inspections and notify the Contractor of any defects. The City will accept the utility for operation only at the time of Initial Acceptance.

The "NOTICE OF INITIAL ACCEPTANCE," which begins the warranty period will be issued when the following items are completed:

- The Inspector has accepted the physical aspects of the construction.
- A "Release and Indemnification" statement has been delivered to Water Engineering.
- All testing requirements, including backfill compaction reports, have been satisfied. Backfill compaction reports must be submitted to the Public Work's Materials Lab for review and approval.
- Record Drawing and CAD Data Files must be reviewed, approved, and accepted by Aurora Water.

Prior to issuance of the initial acceptance, water lines must undergo chlorine, pressure, and bacteria testing and backfill compaction test reports must have been reviewed and approved.

Storm sewers and sanitary sewers require visual acceptance, deflection and air testing as required by Project Delivery Services Inspections. The Contractor is also required to submit a Closed Circuit Television inspection of the line to be reviewed and approved by Aurora Water and to submit the backfill compaction reports for review and approval by the City of Aurora Public Works department for Initial Acceptance.

The Inspector will perform all necessary inspections and notify the Contractor of any noted defects in writing. When all defects are corrected, the work will be accepted for initial acceptance and the warranty period shall begin.

No water service taps are allowed on a newly constructed water main until a Notice of Initial Acceptance has been issued from the Inspector.

Sanitary sewer service permits shall not be issued until the Notice of Initial Acceptance has been issued from the Inspector for the sanitary sewer main.

### **3.07 Warranty Period**

The warranty period for all work is for one (1) year from the date of initial acceptance or unless otherwise specified in this manual or mutually agreed upon in writing.

### **3.08 Final Acceptance for Utilities**

The City may at its discretion re-inspect any project at any time during the warranty period. Any defects noted prior to the warranty expiration shall be corrected by the Owner/Developer/Contractor at their expense. Final acceptance will be issued in writing when defects are corrected, and all repairs to existing facilities, improvements, and vegetation are completed per applicable requirements. When final acceptance has been issued, the infrastructure will become the responsibility of the City of Aurora. Any failures or defects that occur within the warranty period are the responsibility of the owner regardless of timing of inspection(s). Water lines are re-inspected near the end of the warranty period to ensure valves are operable, valve boxes and fire hydrants are to grade, etc. Sanitary sewer and storm drain infrastructure are re-inspected prior to the final acceptance for surface defects. Aurora Water reserves the right to require the Contractor to submit a Closed Circuit Television inspection of the line to be reviewed and approved by Aurora Water prior to the issuance of Final Acceptance. Discrepancy (punch) lists for these items will be mailed to the owner/contractor and must be corrected prior to final acceptance.

## **SECTION 4.00 JOB SITE SAFETY, HEALTH AND ENVIRONMENTAL REQUIREMENTS**

- 4.01 Occupational Safety and Health Administration
- 4.02 Protection of Work and Property
- 4.03 Accident Prevention
- 4.04 Sanitary Regulations
- 4.05 Prevention of Water Pollution
- 4.06 Dewatering
- 4.07 Abatement of Air Pollution
- 4.08 Dust Abatement
- 4.09 Safety and Management of Potential Hazardous Risks

## **SECTION 4.00 JOB SITE SAFETY, HEALTH AND ENVIRONMENTAL REQUIREMENTS**

### **4.01 Occupational Safety and Health Administration**

The Contractor must conform to the rules and regulations of the Occupational Safety and Health Administration. In addition, the Contractor shall conform to all applicable rules and regulations adopted by the City of Aurora. In case of conflict between two or more rules and regulations, the more restrictive shall apply.

### **4.02 Protection of Work and Property**

The Contractor shall continuously maintain adequate protection of all his/her work from damages, and shall protect the City's property from injury or loss arising in connection with his/her construction. He/she shall make good any such damage, injury or loss resulting from such construction. He/she shall adequately protect adjacent property as herein provided. He/she shall provide and maintain all passage ways, guard fences, lights and other facilities for protection required by public authority or local conditions.

The Contractor shall be responsible for protection of all public and private property adjacent to the site of the work including but not limited to pipes, conduits, and other underground structures; overhead wires; and to roadways, alleys, trees, landscaping, bikeways and sidewalks. He/she shall carefully protect from disturbance or damage all land monuments, until a Licensed Land Surveyor has witnessed or otherwise referenced their location, and shall not remove them until directed by the Land Surveyor. The Contractor is subject to state statutes regarding destruction of monuments. When any direct or indirect damage or injury occurs to public or private property by or because of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof on his or her part, then such damaged property shall be restored by the Contractor at his or her own expense to a condition equal to or better than the existing before such damage or injury.

### **4.03 Accident Prevention**

The Contractor shall always, whether or not so specifically directed by the Inspector, take necessary precautions to ensure the protection of the public. The Contractor shall furnish, build, and maintain, at his own expense, all necessary barricades, suitable and sufficient warning lights, construction fencing and construction signs. Contractor shall provide a sufficient number of watchmen and take all necessary precautions for the protection of the work and safety of the Public through or around his construction operations.

#### **4.04 Sanitary Regulations**

The Contractor shall be responsible for providing proper health and sanitation facilities for his employees. Rules and regulations of the Colorado Department of Public Health and Environment, or other bodies having jurisdiction, shall be fully complied with. The Contractor shall always provide an abundant supply of safe drinking water for his/her employees and shall give orders against the use of water in the vicinity of the work known to be unsafe. The Contractor shall provide outside toilets maintained in sanitary condition at convenient locations. Privy toilets which require a hole in the ground shall not be allowed.

#### **4.05 Prevention of Water Pollution**

The Contractor shall comply with City of Aurora Rules and Regulations Regarding Stormwater Discharges Associated with Construction Activities, latest edition.

#### **4.06 Dewatering**

Groundwater Dewatering is not authorized by the City's issued SWMP Permit and is subject to permitting AND APPROVAL by the State and shall be conducted according to an approved City of Aurora dewatering plan through Environmental Inspections Division of Aurora Water.

During construction, suitable dewatering equipment, labor, shall be provided by the Contractor at their own cost. Activities shall be conducted in such a manner as to not disturb or interrupt storm water along their existing drainage courses, and in such a manner as to not disturb or affect any existing surface or subsurface drainage patterns of adjacent properties. The control of surface water as well as groundwater during construction is the Contractor's sole responsibility.

Disposal of groundwater shall be done in accordance to the authorities having jurisdiction as stated on the State issued permit. Treatment of these waters shall follow requirements set by the adequate regulatory agencies.

Additional Standards and Specifications can be found in the *COA Rules and Regulations Regarding Stormwater Discharges Associated with Construction Activities Manual*.

#### **4.07 Abatement of Air Pollution**

The Contractor shall comply with all applicable Federal, State, County and City laws and regulations concerning the prevention and control of air pollution. In conduct of construction activities and operation of equipment, the Contractor shall use such practicable methods and devices as are available to control, prevent, and otherwise reduce atmospheric emissions or discharges of air contaminants.

The emission of dust into the atmosphere shall not be permitted during the manufacture, handling and storage of concrete aggregates or concrete saw cutting. The Contractor shall use such methods and equipment as are necessary for the collection and disposal or prevention, of dust during these operations. The Contractor's methods of storing and handling cement and ad-mixtures shall also include means of eliminating atmospheric discharges of dust.

Equipment and vehicles showing excessive emissions of exhaust gases due to poor engine adjustments, or other inefficient operating conditions, shall not be operated until corrective repairs or adjustments are made.

Burning of materials including trees and brush, combustible construction materials and rubbish IS NOT permitted by the City of Aurora. All such materials shall be removed from the site and legally disposed of at the Contractor's expense.

#### **4.08 Dust Abatement**

During the performance of the work required by these specifications or any operations appurtenant thereto, whether on right-of-way provided by the City or elsewhere, the Contractor shall be required to furnish and apply a dust palliative on portions of the project and on haul roads at the locations and in the amounts as may be called for on the plans or as directed. Dust palliate may consist of water or a dilution of water and emulsified asphalt, or other approved substance. Dust palliative shall be of the type and proportions called for on the plans, or as directed. Spreading of water or water mixture shall be done with acceptable sprinkling equipment. The Contractor shall be held liable for any damage resulting from dust originating from his operations under these specifications on right-of-way or elsewhere.

#### **4.09 Safety and Management of Potential Hazardous Risks**

The following paragraphs highlight criteria the City of Aurora will enforce to protect public health, critical infrastructure and the environment. The outlined criteria includes, but is not limited to, Oil and Gas sites, private utility transmission and distribution lines, hazardous substances designated under Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and any chemical the facility is required to report pursuant to Section 313 of title III of the Superfund Amendments and Reauthorization Act (SARA).

#### **Private Utility Alignment, Depth, and Easement**

City of Aurora existing and future utility infrastructure shall be provided first priority within existing and future Right of way. All private utility pipelines shall be located a minimum horizontal distance of ten (10) feet outside the edge of existing or future Right-of-way, whichever is the greater.



When private utility pipelines are planned with parallel alignments to City of Aurora utilities that are not subject to future dedicated Right-of-way (i.e. Interstate 70), then private owners shall be responsible to secure additional utility easement sufficient to construct, operate, and maintain their utilities.

All subsurface private infrastructure including energy development wells, tanks, and other major buried utility infrastructure shall be located a minimum horizontal distance of 500 feet from any existing or proposed City of Aurora utility and any regulated floodway. All private utility pipeline crossings shall be located a minimum vertical distance of ten (10) feet below any existing or proposed City of Aurora utility. Crossings of City utilities may be subject to additional requirements including, but not limited to, enhanced utility protection and stabilization. No grading within a City of Aurora utility easement will be permitted.

All private proposed utility infrastructure will require approved Site Planning and Civil Construction Documents for construction in accordance with the latest City of Aurora Design Standards and Specifications. All sites are subject to individual and separate reviews.

### **Water Supply and Ownership**

All sites shall prepare and submit a water use plan in conformance with CDPHE Regulation 84 (effective July 30, 2013) as described in Section 84.9 to the City of Aurora for approval. In addition, a separate water agreement between the Customer and the City of Aurora shall be required.

All fresh water pipelines used for water supply shall be constructed of High Density Polyethylene Pipe (HDPE) with a minimum Pressure Class of 250 psi and shall be in conformance with the City of Aurora Standards and Specifications for Water, Sanitary Sewer, and Storm Drainage Infrastructure, latest edition. All fresh water lines constructed by the Owner will become City of Aurora property one (1) year after project completion is finalized.

### **Groundwater Monitoring**

Water quality must be monitored around all well pad sites via all existing groundwater wells within a ½ mile radius at a minimum frequency of once per year. If no groundwater monitoring wells exist, then a minimum of two (2) monitoring wells must be installed to monitor the Denver Basin Aquifer downgradient of all well production sites.

### **Stormwater Management**

All sites will require a City of Aurora Stormwater Quality Discharge Permit for Construction Activities. A Stormwater Management Plan and Report shall be prepared in accordance with the City of Aurora Rules and Regulations regarding Stormwater Discharges Associated with Construction Activities, latest edition. As with other types of projects, having a permit from the State of Colorado or other entities does not eliminate the requirement to obtain a permit from City of Aurora, just as having a permit from the City of Aurora does not relieve obligations to obtain required permits from the State of

Colorado and other agencies having jurisdiction. Proposed projects located within the Cherry Creek Watershed also must comply with the Cherry Creek Reservoir Control Regulation, Regulation No. 72 (5 CCR 1002-72), latest revision.

## **SECTION 5.00 DESIGN CRITERIA AND CONSTRUCTION PLANS**

- 5.01 General
- 5.02 Water Distribution Lines Design Criteria
- 5.03 Sanitary Sewer System Design Criteria
- 5.04 Alignment, Depth and Easements
- 5.05 Civil Construction Plan Requirements
- 5.06 Manhole Spacing
- 5.07 Manhole Barrel Size
- 5.08 Irrigation Plans
- 5.09 Storm Water Maintenance and Inspection Plans
- 5.10 CAD Files
- 5.11 Record Drawings

## **SECTION 5.00 DESIGN CRITERIA AND CONSTRUCTION PLANS**

### **5.01 General**

Civil Plans and Reports shall be submitted in accordance with requirements outlined in the Roadway Design and Construction Specifications latest edition. All commercial site developments are required to submit a civil plan for review and approval. All plans shall be checked by the Engineer for conformance with the minimum design criteria set forth in these specifications prior to approval for construction.

#### **5.01.1 Stormwater Management Infrastructure**

Storm water management infrastructure and appurtenances requiring maintenance (e.g. detention ponds, improved channels, conveyance systems, etc.) require a submitted civil plan set that identifies maintenance responsibilities, and the party responsible for maintenance.

### **5.02 Water Distribution Lines Design Criteria**

All additions to the City of Aurora water distribution system shall be designed in accordance with the criteria set forth in this and other sections of these specifications as approved by the City Engineer and the Aurora Water Department. Ductile Iron Pipe (DIP) or Polyvinyl Chloride pipe (PVC) shall be used exclusively, unless special approval is obtained in writing by Aurora Water Engineering.

#### **5.02.1 Master Water Plan and Report**

A master water plan (minimum scale 1"=100') shall be submitted for each major development with the Framework Development Plan (FDP) or Contextual Site Plan (CSP) prior to approval of any portion of the water system as required by Aurora Water Engineering. Master water plans shall otherwise conform to the drafting guidelines outlined in the Roadway Design and Construction Specifications latest edition. A Master Water Report shall have a narrative identifying the scope, intent, criteria, water system requirements, and phasing of improvements. Furthermore, the report must analyze the proposed distribution system for Average Day, Maximum Hour and Maximum Day plus Fire Flow per currently adopted fire code. Water master plans shall be evaluated relative to the City-wide master plan, and all phases of construction must meet minimum criteria established by the City's master plan to ensure regional water transmission goals.

#### **5.02.2 Main Size**

The water distribution system shall be designed to meet the following maximum hour to average day and maximum day to average day ratios:

<b>Ratio</b>	<b>Peaking Factor</b>
Max Hour: Average Day	4.5:1
Max Day: Average Day	2.8:1

The system shall be analyzed to meet the maximum day plus fire flow demand (as determined by ISO criteria) with a residual pressure of no less than twenty (20) psi at any point in the water distribution system. The fire flow demands by land use type are as follows:

<b>Use Classification</b>	<b>Fire Flow Demand</b>
Residential	1,500 gpm for 2 hrs
Commercial/Multifamily	2,500 gpm for 2 hrs
Industrial	3,500 gpm for 3 hrs

The maximum velocity and head loss requirements based on pipe diameter are below:

<b>Pipe Diameter (in)</b>	<b>Max Velocity (fps)</b>	<b>Head Loss Not to Exceed (ft / 1,000 ft)</b>
6	2.5	5
8 to 12	3	5
16 to 24	4.5	5
>24	7.8	4

Design parameters and critical conditions shall be shown on an overall plan of the study area. In addition the following minimum conditions shall be met:

- The minimum diameter for water mains in single family detached residential areas shall be eight inches (8"), unless six inch (6") pipe is required in a particular location by the Aurora Water Engineering due to potential water quality issues.
- A maximum of twelve (12) residential units are allowed to be served from a dead end water main.
- Water mains servicing schools, commercial, industrial, retail developments, and multi-family attached residential areas shall be a minimum of eight inches (8") in diameter.
- Aurora Water Engineering may require larger mains based upon regional needs.
- Four inch (4"), ten inch (10") and fourteen inch (14") mains are not allowed.

### 5.02.3 Domestic Water Demand per Zoning Classification

#### Residential

Zoning	People per Unit	Average Day Per Capita Flow (gpd)
Residential	2.77	101

#### Non-Residential

Zoning	Average Day (gpd/acre)	Max Day (gpd/acre)	Max Hour (gpd/acre)
Commercial	1,500	4,200	6,750
Industrial (including schools)	1,200	3,360	5,400
Parks	1,800	5,040	N/A

### 5.02.4 Fire Hydrants

Dead-end water lines supplying fire hydrants must maintain a minimum available residual pressure of twenty (20) psi for firefighting purposes. No more than one (1) fire hydrant is allowed off of a dead-end water line extension. The water line supplying the dead-end line must be supplied from a looped system. Any dead-end water line supplying a fire hydrant that exceeds one hundred fifty (150) feet require calculations to be shown on the utility sheet of the civil drawings. The calculation provided must reflect no less than a twenty (20) psi residual water pressure.

### 5.02.5 Sampling Stations

Sampling stations for the purpose of monitoring water quality within the distribution system will be required as determined by Aurora Water Engineering. Installation of the stations shall be the developer's responsibility and will be shown on project site plans. Specific locations for the stations will be at the discretion of the Aurora Water Director or his duly authorized representative. Stations should be located within five feet (5') of a fire hydrant.

## 5.03 Sanitary Sewer System Design Criteria

The following shows the recommended sewer loading rates for a variety of types of developments. These rates for the design of sanitary sewers shall be used as a general guide for designers in addition to the ASCE Manuals and Reports on Engineering Practice No. 60, Gravity Sanitary Sewer Design and Construction (Manual) Second Edition. The peak flow shall be based on Curve "A" of the Manual for the ratio of peak to average daily sewage flow as determined and shown on Figure 3-1 of the Manual:

The equation for Curve "A" is:  
$$5 \div p^{0.167}$$
 where p = population in thousands

A maximum peaking factor of four (4) and a minimum of 1.7 shall be used for this equation.

The master utility study should include the estimated peak quantity of wastewater tributary to the study area and included with the report. A Framework Development Plan or a General Development Plan, which is a part of the master plan for the City of Aurora, shall be the basis for determining the character of developed land outside the study area. The proposed outfall points for wastewater, demand per each type of unit, number of units, peaking factor, infiltration at ten percent (10%) of average flow, and maximum daily demand from the study area should also be included in the master utility report. All sanitary sewer systems shall be designed in accordance with the criteria established by the Colorado Department of Public Health and Environment with the following exceptions:

**5.03.1** There shall be no horizontal or vertical curves on sanitary sewers.

**5.03.2** All sanitary sewer mains shall end with a manhole except where a short four feet (4') maximum) stub-out section from the last manhole may be allowed for future main extensions or private service connections.

**5.03.3** The flow velocity shall not exceed ten feet (10') per second flowing full or 1/2 full using Manning's formula and ( $N=0.011$  for PVC) or ( $N=0.013$  for RCP or VCP). Minimum Slope = 0.4%, with a minimum velocity of two feet (2') per second at least once per day.

**5.03.4** Minimum drop through a manhole from inlet to outlet for same diameter pipe shall be:

- 0.2 ft. on straight through runs
- 0.3 ft. on deflected bends greater than forty-five degrees ( $45^\circ$ ); pipe laid through a manhole shall be at a slope of the same grade as the downstream pipe slope
- For pipes of differing diameters, match HGL's or crowns of pipes.
- Engineer shall use a pipe stiffness greater than forty-six (46) psi for depths greater than twenty (20) feet.

**5.03.5.** A maximum inside drop of eighteen inches (18") from inlet to outlet for pipe is allowed, if the inlet pipe must avoid upstream conflict or by authorization from Aurora Water.

**5.03.6** Depth of flow in pipes should not exceed seventy-five percent (75%) of capacity for pipes twelve inches (12") or smaller and eighty percent (80%) for pipes larger than twelve inches (12").

**5.03.7** Minimum diameter of service lines is four inches (4"). Minimum slope on four inch (4") service lines is two percent (2%). Other size service lines require a minimum two (2) feet per second velocity once per day.

**5.03.8** Direct service line taps shall not be allowed on sewer mains twenty-four inches (24") in diameter and larger.

### 5.03.9 Recommended Sewer Loading Rates for Different Types of Developments

#### Residential

Zoning	People per Unit	Loading Rate (gpcd)
Residential	2.77	68

#### Non-Residential

Zoning	Average Day (gpd/acre)	Equivalent Population per Acre
Commercial	1,500	22
Industrial (including schools)	1,200	18

Add Inflow and infiltration at ten percent (10%) of average flow for all zonings. (Do not peak I & I).

### 5.04 Alignment, Depth and Easements

Water mains shall be placed ten feet (10') north and east of street centerlines and no closer than ten feet (10') horizontally from sanitary sewer when measured from edge to edge. Large diameter mains may require greater separation. For parkways or a major arterial with twenty foot (20') or twenty-six foot (26') wide islands, water mains shall be placed twenty feet (20') or twenty-four feet (24'), respectively, north and east of street centerlines. Water mains shall be a minimum of five feet (5') from the edge of the concrete gutters at all locations, except as approved by the Aurora Water.

A minimum cover of four and one-half feet (4½') below final grade shall be maintained over all water mains and service laterals. Curvilinear PVC water mains are not allowed and must be provided horizontal bends. Ductile iron water mains may be curvilinear with joint deflection accurate to manufacturer recommendations.

When water pipes cross sanitary sewer lines, the water line must be laid above the sanitary sewer line with a twenty-four inch (24") minimum vertical separation (includes water and sanitary services) with all pipe joints no closer than ten feet (10') horizontal from the sanitary sewer pipe centerline. In the case where a twenty-four inch (24") separation cannot be kept or sewer lines cannot be located below the water line, special design to protect water quality will be required. This may include concrete or steel encasement of the sanitary sewer main for a length of ten feet (10') on both sides of the crossing (for a total length of twenty feet (20')) at the direction of Aurora Water Engineering. For more information on specific crossing parameters, see Section 11.08 of these specifications.

Drainage easements are required for private storm water systems and utility easements must be provided for storm water systems that are owned and maintained by the Aurora



Water.

Water mains, sanitary sewers, and storm sewers are required to extend the complete length of the property frontage or completely through the property being served if there is any possibility of a future extension of the main.

In no instance shall manholes or valves encroach on curb and gutter sections, cross pans, etc. Meter pits and curb stop valves are not allowed in, or under, driveways, sidewalks or curb and gutter.

#### Meters and Hydrants Required Easements

Fixture	Easement
$\frac{3}{4}$ " to 1" meter	10' wide and 5' behind meter pit <u>or</u> in R.O.W. behind back of walk or in the tree lawn if detached walk is required
1½ " to 2" meter	10' wide and 5' behind meter pit
3", 4", 6"	18' wide and 5' behind meter pit
Fire Hydrant	10' wide and 5' behind hydrant

#### Utility Mains Required Easements\*

Average Depth of Main	Easement
0'-6'	16' wide
6'-10'	20' wide

Mains greater than ten feet (10') in depth require easement dedication width to provide a 1:1 slope from the edge of the easement to the bottom of the pipe. Easements covering more than one wet utility require a width sufficient to provide a 1:1 slope from the edge of the easement to the top of the bedding envelope of the outside pipe.

\*Two (2) parallel public utilities shall be provided twenty-six feet (26') width minimum easement.

In no case shall any walls, large rocks, fences, etc., be within a utility easement or within eight feet (8') of a public utility line unless prior approval has been obtained from the Water Department and license agreement has been obtained. No trees are allowed in public utility easement or within eight feet (8') of a public utility. It is the responsibility of the designing firm to coordinate with the landscape architect during preliminary site development to avoid locating such landscaping features within a utility easement.

## **5.05 Civil Construction Plan Requirements**

Civil construction plans for water, sanitary sewer and storm sewer infrastructure shall conform to the requirements set forth in Public Works Roadway Design and Construction Specification latest edition.

**Preliminary design potholing or field confirmation of invert elevations is required for all locations where proposed utility infrastructure crosses existing infrastructure. Furthermore, field confirmation of existing invert elevations is required for proposed connections. This information must be provided on all civil drawing submittals as necessary. Traffic control plans are required for all work within the public R.O.W. where applicable.**

Additionally, the following requirements shall be met for plan approval as applicable:

### **5.05.1 Standard Notes**

The following notes must appear on all overall water plans:

- 1) All materials, workmanship, construction details, and testing for the water line construction shall conform to Standards and Specifications Regarding Water, Sanitary Sewer and Storm Drainage Infrastructure latest revision as set forth by the Aurora Water.
- 2) All fire hydrants shall be located not less than three feet - six inches (3'- 6") and not more than eight feet (8') from the back of curb to the center of the hydrant and be unobstructed on the street side. Minimum clearance on all other sides shall be five feet (5'). Fire hydrants must be grade staked in the field. Fire hydrants are not allowed in sidewalks.
- 3) All fire hydrants must be grade staked in the field whenever curb and gutter has not been installed.
- 4) All utility easements must remain unobstructed and fully accessible along their entire length for maintenance equipment.
- 5) Water main restraint shall be in accordance with Standards and Specifications Regarding Water, Sanitary Sewer and Storm Drainage Infrastructure latest revision. Megalugs or Uni-flange may be used in place of rods and clamps.
- 6) Water line valves are not allowed in cross pans.
- 7) All water meters, water service lines and sanitary sewer service lines are not allowed in or under driveways.
- 8) All sanitary service lines shall be tees off of mains. Wyes shall be used for lots at back of cul-de-sacs, or upstream of a dead-end manhole.

- 9) Water Pressure Zone \_\_\_\_\_(insert water pressure zone where development is located). Zero (0) psi @ elevation \_\_\_\_\_(insert static elevation for specific zone) static. A Pressure Reducing Valve (PRV) is required when the pressure at the building unit is greater than eighty (80) psi. PRV's are not allowed in City of Aurora owned and maintained meter pits.
- 10) Adjust all manholes, fire hydrants, and valve boxes to grade per Aurora Water Standards and Specifications Regarding Water, Sanitary Sewer and Storm Sewer Infrastructure latest revision, as necessary.
- 11) Fire service lines without chemical feed systems require at least a double check backflow assembly. All other fire lines, commercial, multi-family and master metered single family residential water service lines require a reduced pressure backflow assembly. Contractors are required to contact Aurora Water to schedule a backflow assembly inspection prior to the issuance of a certificate of occupancy.
- 12) The Contractor shall contact Aurora Water Engineering at 303-739-7370 for inspection of any required grease traps or sand/oil interceptors prior to the issuance of the certificate of occupancy.
- 13) The Contractor shall contact the Aurora Water Inspection Line at 303-739-7385 at least two (2) business days in advance of commencing construction of any wet utility to schedule inspections.
- 14) For all commercial and multi-family sites, Total Building Surface Area = \_\_\_\_\_ S.F. and Total Hard Surface = \_\_\_\_\_ S.F. per building.
- 15) The Soils Resistivity test was performed and the resistivity is \_\_\_\_ Ohm – centimeter.

**5.05.2 Resistivity Tests.** Specifying PVC pipe on the civil plan submittal does not eliminate the need for resistivity testing. These resistivity tests must be submitted with the civil plans first submittal, or the plans will be rejected at the time of the first submittal.

If resistivity is less than or equal to one thousand (1,000) ohm-centimeters, PVC water main for line twelve inches (12”) and under in diameter, including fire hydrant laterals, is required for the site. DIP and steel for larger diameter mains may be used in these soil conditions with appropriate cathodic design per these specifications.

For sites using PVC mains under the above conditions, the following notes are required to be added to standard utility notes:

- 1) Ductile iron and steel pipe shall not be used on this site due to the corrosive nature of the soils. All pipe shall be PVC per the Standards and Specifications Regarding Water, Sanitary Sewer and Storm Drainage Infrastructure latest revision.

- 2) All ductile iron fittings and appurtenances shall be double bonded and double poly-wrapped per the Standards and Specifications Regarding Water, Sanitary Sewer and Storm Drainage Infrastructure latest revision.

### **5.05.3 Water Services**

Fixture unit table and meter sizing table per these specifications are required for all commercial and multi-family water services. Meters shall be sized per the current Uniform Plumbing Code as adopted by the City of Aurora Building Division.

All water service connections and meters shall be uniform size from the service line tap to the building structure or structures. Aurora Water shall reserve the right to require a larger service connection to any building, structure, or development if the water requirements when calculated by the fixture unit method, as specified in the International Plumbing Code, cause the service line velocity to exceed ten feet (10') per second. Each service line and meter shall supply a specific building. The banking of meters where a particular building or group of buildings may be supplied by two (2) or more meters shall be prohibited, except in circumstances where two (2) meters may be allowed by the General Manager of Aurora Water or his authorized representative.

Service connection fees are payable after issuance of building permit and one (1) business day prior to request for meter set. The fee shall be calculated on the basis of service connection fees in effect as of the date of full payment. Water stub-outs not utilized at the time of development require disconnection at the main. Disconnection of existing unused water lines shall be the developer's responsibility. Water services may not be tapped from mains larger than twelve inches (12") in diameter.

A fullway valve controlling all outlets shall be installed on the discharge side of each water meter. Water piping supplying more than one building on any one premises shall be equipped with a separate fullway valve to each building, provided, however, the supply piping to a single family residence and building accessory thereto may be controlled on one valve. Such shut-off valves shall be readily accessible at all times. A fullway valve shall be installed for each apartment or dwelling for more than one (1) family.

See Section 23 for sanitary sewer service criteria.

### **5.05.4 Fire Suppression Lines**

Proposed fire suppression lines to each building shall be shown and labeled "Private". Individual fire service lines are required for each sprinkled building and must be tapped from a looped water main. All fire service lines shall be Ductile Iron for lines three inch (3") and larger or type 'K' copper for lines two inch (2") and smaller from the main line to the backflow assembly in the building, except as explicitly approved by Aurora Water based on resistivity tests. Two inch (2") and smaller fire service lines shall have a tee and four inch (4") gate valve with a two inch (2") or smaller threaded plug, copper service threaded union, and service insulator per these specifications. Three inch (3") fire lines shall have a tee, four inch (4") gate valve, and four inch (4") by three inch (3") reducer per

these specifications. In no case shall a gate valve less than four inches (4") in diameter or a gate valve more than ten inches (10") in diameter be installed on a fire service line at the main.

When a fire sprinkler system or standpipe system is being installed within any structure the following notes are required:

- 1) All fire service lines shall be installed, in their entirety, by a state licensed contractor. Licensing can be obtained from the Colorado Department of Public Safety, Division of Fire Prevention and Control located at 690 Kipling Street, Suite 2060, Lakewood, CO 80215, 303-239-4600 or online at [www.dfpc.state.co.us](http://www.dfpc.state.co.us). In addition, approved civil plans from the Aurora Water Department are required for all fire service line connections. The Contractor must present license and approved civil plans to the Permit Center before permits are issued.
- 2) Upon permit issuance contact the City of Aurora Building Division at 303-739-7420 to schedule a flush inspection with a Life Safety Inspector.
- 3) Fire service lines shall be restrained for their entire length. Refer to Standards and Specifications Regarding Water, Sanitary Sewer and Storm Drainage Infrastructure, of these specifications latest edition.
- 4) Other than the ninety degree (90°) vertical bend in the fire service line at the building riser, fire service lines may have one ninety degree (90°) bend, or more than one (1) bend when the sum of all bends does not exceed ninety degrees (90°), in the length of line from the water main tee to the riser. Submission of hydraulic calculations and a revised civil drawing is required if the sum of all bends exceeds more than ninety degrees (90°).
- 5) No connections are allowed to the fire service line between the gate valve at the water line main and the backflow preventer (within the building).

## 5.06 Manhole Spacing

The maximum distance between manholes shall be as follows:

Sanitary	
<u>Pipe Size</u>	<u>Maximum Distance</u>
8" to 15"	400'
18" to 30"	500'
Larger than 30"	600'
Storm	
<u>Pipe Size</u>	<u>Maximum Distance</u>
18" to 36"	400'
42" to 60"	500'
Larger than 60"	750'

Manholes are required for all junctions in the storm sewer system unless specifically authorized by Aurora Water Engineering. Maintenance access is required to within five feet (5') of all manholes. Maintenance access shall be a minimum width of twelve feet. Centerline radii less than fifty feet (50') will require the access to be widened to accommodate the turning movement of maintenance vehicles, i.e., tandem axle dump trucks. In no case shall the centerline radii be less than thirty feet (30'). The maximum grade shall be ten percent (10%). Where tributary areas are less than five (5) acres in size the maximum longitudinal slope may be considered on a case by case basis for approval of no steeper than 4H:1V (horizontal:vertical).

Maintenance access for water, sanitary and storm sewer lines and manholes are required to be designed for HS-20 loading.

## 5.07 Manhole Barrel Size

The size of pipes into the manhole shall determine the barrel size used.

The internal diameter of the manhole barrel shall be as follows:

Sanitary		
<u>Pipe Size</u>		<u>Barrel Size</u>
12" or less		48"
15" to 27"		60"
30" to 48"		72"
Storm		
<u>Pipe Size</u>		<u>Barrel Size</u>
27" or less		60"
30" to 48"		72"

A larger barrel size may be required when a separation of one foot (1') inside the manhole between outside diameters of incoming/outflowing pipes cannot be met. CDOT M-Standards may be used for pipes larger than forty-eight inches (48"). Structural calculations shall be required to be submitted with the first civil plan submittal if CDOT M-Standards are used and the bury depths exceed the maximums in the CDOT M-Standards. If they are not submitted with the first submittal, this is cause reject the first submittal until such time as the structural calculations are included. Landing platforms shall be provided only when specifically requested by Aurora Water.

## 5.08 Irrigation Plans

Irrigation plans are required to be submitted and approved by Aurora Water for all new multi-family, commercial and common space development as a separate submittal from the Civil Plan submittal. Irrigation systems must be inspected prior to Certificate of Occupancy. See Appendix D: Irrigation System Standards and Details for more information.

### **5.09 Storm Water Inspection and Maintenance Plans**

Prior to approval of civil plans, the owner must submit a Storm water Inspections and Maintenance Plan, which includes a Storm Water Inspection and Maintenance Agreement, to cover inspection and maintenance for any permanent storm water best management practices. The current template can be obtained through the City of Aurora Office of Development Assistance.

### **5.10 CAD Files**

Digital Submission of CAD Data files is required by consultants on development projects when submitting to the City for approval of signature sets and on capital projects funded by the City. Details of the CAD Data Submittal Standard can be found on the City Website, under the [CAD Standards](#) web page.

### **5.11 Record Drawings**

Record Drawings shall be prepared by and certified by the Engineer of Record. Digital Submission of Record Drawings in PDF and CAD Data are required by consultants on development projects and capital projects funded by the City prior to initial acceptance. A completed check-list shall be submitted with each submittal.

The following table is **REQUIRED** on **all OVERALL WATER MAIN CONSTRUCTION PLANS**.

# STANDARD

[illegible]

- Fixture unit values can be discounted 30% for water-saving devices
- Based upon International Plumbing Code (Latest Edition)
- Maximum velocity in any segment of the service line from water main to building is 10 F.P.S.
- Meter sizes subject to re-review if tenant finish is required for commercial or industrial buildings.
- Refer to the current adopted International Plumbing Code for definitions of Public versus Private fixtures.



## **SECTION 6.00 PROTECTION OF EXISTING FACILITIES**

- 6.01 General
- 6.02 Concrete Work
- 6.03 Pavement Replacement
- 6.04 Underground Utilities

## **SECTION 6.00 PROTECTION OF EXISTING FACILITIES**

### **6.01 General**

The Contractor shall notify all utility companies (Electric, Gas, Telephone, Cable T.V., etc.) and all other necessary parties before commencement of work. Existing power lines, telephone lines, trees, shrubbery, fences, water mains, irrigation systems, gas mains, sewer mains, sewers, cables, conduits, ditches, embankments, and other structures in the vicinity of the work not authorized to be removed shall be supported and protected from injury by the Contractor during the construction and until completion of the work affecting them. The Contractor shall be liable for all damages to such existing facilities and structures, as herein provided, and he/she shall hold the City harmless from any liability or expense for injuries, damages, or repairs to such facilities.

All paving, curbing, sidewalks, gutters, turf, native grasses, trees, shrubbery, fences, irrigation ditches, pipes or other structures or surfaces damaged during construction shall be replaced to an equal or better condition at the Contractor's expense. This work shall be done when conditions warrant and shall be completed to the satisfaction of the Engineer. Upon completion of construction, surplus materials, equipment, tools and temporary structures shall be removed by the Contractor. All dirt, rubbish and excess earth from excavations shall be properly disposed of by the Contractor and the construction site shall be left clean and orderly. Construction done on private property shall be restored to a condition at least equal to or better than before work began and to the satisfaction of the Engineer. Contractor and/or owner are required to satisfy requirements of the City's Tree Mitigation Policy.

The Contractor shall not use private property outside construction easements without first obtaining written permission from the property owner. This permission shall be worded so as to hold the City, its employees and agents harmless.

### **6.02 Concrete Work**

All concrete used in restoration work including all curb, gutter, sidewalk and concrete street replacement work shall conform to the requirements set forth in the City of Aurora, Roadway Design and Construction Specifications, latest edition, or to the requirements of the Street or Highway Department having jurisdiction. All concrete used in City of Aurora Parks, Recreation and Open Space properties shall conform to the Parks, Recreation and Open Space Development Manual.

### **6.03 Pavement Replacement**

Unless authorized by the Engineer, all pavement shall be replaced per the City of Aurora Public Works Roadway Design and Construction Specifications latest edition. Permanent or temporary surfacing shall be installed and maintained as required by the Engineer. All pavement used in City of Aurora Parks, Recreation and Open Space properties shall conform to the Parks, Recreation and Open Space Development Manual. If the Contractor fails to give timely response to the Engineer's request for installation or maintenance of the surfacing, the Engineer will arrange for the required work to be done at the Contractor's expense. If it becomes necessary for the Engineer to instigate such an action, a hold may be placed on all future permits until the problem is rectified.

### **6.04 Underground Utilities**

The type, size, location, and number of all known underground utilities are approximate when shown on the drawings. It shall be the responsibility of the Contractor to verify the existence and location of all underground utilities within the work area. The Contractor shall be responsible for unknown underground utilities.

The Contractor shall notify the appropriate City Department or owner of the existing utilities, whether above ground or underground, before proceeding with trench excavation whenever such trenching operations are within ten feet (10') of any existing utilities. Should any such utility be damaged in the trenching operations, the Contractor shall immediately notify the owner of such utility. Unless authorized in writing by the owner of the utility, the Contractor shall not attempt to make repairs. Duplicate copies of any written authorization given to the Contractor to make repairs shall be filed with the Engineer and shall be so worded as to hold the City harmless of any responsibility whatsoever concerning the sufficiency of the repairs.

If during construction, it is determined that any underground utility conduit including, but not limited, to sewers, water mains, gas mains, drainage structures, and any above ground utility facilities are required to be moved, the Contractor shall notify the utility owner before his approach to such utility so arrangements with the City or owners of the affected utility can be completed without delay to the work.

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## **SECTION 7.00 MATERIAL HANDLING AND STORAGE**

7.01 General

7.02 Materials Handling

7.03 Materials Storage

## **SECTION 7.00 MATERIAL HANDLING AND STORAGE**

### **7.01 General**

Unless otherwise specified, all pipe handling and storage shall be based upon manufacturers' recommended practice for installation of each specified type of pipe. Provisions of these specifications shall supersede and augment those recommendations.

### **7.02 Material Handling**

All materials shall be delivered to the construction site free of contamination. Contamination shall include, but not be limited to, dust, dirt, mud, petroleum products, trench water, paint, pesticides, stones, animals, and insects.

Pipe, fittings, and accessories shall be loaded and unloaded by lifting with hoists or skidding to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. If any part of the coating or lining is damaged, the Contractor shall repair or replace the material affected at his expense as required by the Engineer or Inspector.

Precautions shall be taken to prevent contamination of the materials. The Inspector shall stop all work when he/she deems the work to be unsafe, inconvenient, or when proper contamination control is not exercised.

### **7.03 Material Storage**

Pipe ends shall be capped while in storage at all times. Pipe shall not be stacked higher than allowed by the manufacturer. Stringing of pipe is allowed but shall be free of debris before placement of the pipe. Stored pipe shall be protected from adverse weather, harmful chemicals, dirt or debris accumulating on the interior of the pipe. The Contractor before placement shall remove any deleterious material from the interior of the pipe. PVC and HDPE pipe shall be protected from long term exposure to sunlight.

## **SECTION 8.00 EXCAVATION**

- 8.01 General
- 8.02 Trench Excavation
- 8.03 Trench Side Walls
- 8.04 Shoring
- 8.05 Rock Excavation
- 8.06 Blasting
- 8.07 Pavement Removal
- 8.08 Preparation for Pipe Laying

## **SECTION 8.00 EXCAVATION**

### **8.01 General**

Except where shown otherwise on approved drawings, and unless the Engineer gives written permission to do otherwise, all trench excavation shall be made by open cut to the depth required to construct the pipeline as shown on the drawings. The length of a trench permitted to be open at any one time is limited per City of Aurora Rules and Regulations Regarding Storm Water Discharges Associated with Construction Activities.

All earthworks and structural excavation and backfill shall conform to the City of Aurora Roadway Design and Construction Specifications latest edition.

### **8.02 Trench Excavation**

The width of trenches shall be only the width necessary for the proper placement of the pipe. There shall be a minimum of eight inches (8") between the trench wall and the wall of the pipe or eighteen inches (18") if a trench box is used. All unauthorized excavation below the established depth made without the written authorization of the Engineer shall be refilled with compacted granular bedding material per Section 9.00. Trenches in existing streets are subject to the provisions of the City of Aurora Roadway Design and Construction Specifications latest edition.

### **8.03 Trench Side Walls**

When the trench side walls are sloping or benched, the sloping or benching shall end at a depth not less than one foot (1') and no greater than four feet (4') above the top of the pipe barrel. From this point down the trench wall shall be vertical. The trenching operation, including the spoil band, shall be confined to the width of the combined permanent and temporary right-of-way. Under no circumstances shall the Contractor use any areas outside these right-of-ways without first receiving written permission, holding the City harmless, from the property owner.

A clear area shall be maintained a sufficient distance back from the top edge of the excavation to avoid overloading which may cause slides or caving of the trench walls. The excavated material shall be kept trimmed enough to be of as little inconvenience as possible to the public and adjoining property owners. Unless otherwise authorized by the Public Works Traffic Engineering Division, all public thoroughfares and crossroads shall be kept open to safe two-way traffic in accordance with the approved traffic control. At street crossings, sidewalks and other points where the Engineer deems necessary, the trenches shall be bridged safely to prevent serious interruptions of travel and to provide access to fire hydrants and public and private premises. Such bridging shall be approved by the Engineer.



## **8.04 Shoring**

All trench side walls which require shoring shall be properly sheeted and braced to furnish safe working conditions. The shoring shall be arranged so as not to place any stress on portions of the completed work until the general construction of the work has proceeded far enough to provide ample strength. Any damage to pipes or structures occurring through settlements, heaving, water or earth pressures, slides, caving or other causes, due to failure of shoring, or due to improper shoring, or due to negligence by the Contractor, shall be repaired by the Contractor at his/her own expense. Sheet piling may be used for shoring. Shoring shall be removed as work progresses, unless left in place, by written order of the Engineer.

If at any point the Engineer determines the trench walls to be not properly supported, he/she may order the placement of additional supports by and at the expense of the Contractor. Compliance with such an order shall not relieve or release the Contractor from his responsibility for the safety of the work.

The Contractor is responsible for ensuring his/her work complies with all necessary OSHA guidelines.

## **8.05 Rock Excavation**

Rock excavation shall consist of igneous, metamorphic and sedimentary rock which cannot be excavated without blasting or the use of rippers, and all boulders or other detached stones each having a volume of two (2) cubic yards or more. Where rock, hardpan or other unyielding material is encountered, it shall be removed below the designed grade for a depth of six inches (6"). This extra depth excavation shall be backfilled with compacted granular bedding material per these specifications.

## **8.06 Blasting**

Excavation blasting shall be permitted for portions of the work which may be expedited if a written permit is given by the Engineer, and a permit is granted by the City of Aurora Fire Department. These permits shall be kept on site for inspection. The Engineer shall have the right to limit the use of explosives or to order the discontinuance of any blasting methods which in their opinion endanger the safety of inhabitants of the area, the traveling public or any part of any public or private property.

The Contractor shall enlist the services of a Professional Explosives Engineer. All blasting shall be according to the Explosive Statutes of Colorado.

Blasting shall be performed in a manner that no damage will result to any building, structure, pipeline, or facility on or off the site of the work, or above or below ground line. Any damage suffered because of blasting shall be repaired to the satisfaction of the Engineer, at the Contractor's expense. Blasting shall be done so the rock is not loosened nor disturbed below the pipe foundation. Blasting in a trench shall not proceed until the trench walls have been shored or braced satisfactorily to the Engineer.

## **8.07 Pavement Removal**

Excavation in paved streets shall meet the minimum trench width requirements. Excavations within paved City Streets are subject to the provisions the City of Aurora Roadway Design and Construction Specifications latest edition.

**There shall be no dumping of unauthorized material inside the city limits of the City of Aurora.**

## **8.08 Preparation for Pipe Laying**

When the excavation is in firm earth, care shall be taken to avoid excavation below the established grade plus the required specified over-excavation to accommodate the granular bedding. Over excavation shall be replaced using stabilization materials and compacted to City specifications unless otherwise specified in writing by the Engineer.

### **8.08.1 Unstable Trench Conditions**

When soft or otherwise unstable foundation materials are encountered in the bottom of the trench these materials shall be removed and replaced with a six inch (6") minimum layer of stabilization materials or a concrete cradle. Materials which are wet do not solely constitute unstable foundation material.

### **8.08.2 Stabilization Material**

Stabilization material shall be uniformly graded, angular, washed rock conforming to the following sieve analysis. A layer of Mirafi 140 and a minimum of six inches (6") of granular bedding material shall be placed over the stabilization material as required per Standard Detail 100.

#### **Stabilization Material**

<u>Sieve Size</u>	<u>Percent Passing</u>
2"	95 - 100
1"	35 - 70
1/2"	10 - 30
#4	0 - 5

### **8.08.3 Removal of Water**

The trench shall be kept free from water during excavation, fine grading, pipe laying and jointing. Dewatering sufficient enough to maintain the ground water level below the pipe grade shall be accomplished before pipe laying and jointing. The dewatering operation shall be carried out so it does not destroy or weaken the strength of the soil under or alongside the trench.

**Dewatering requires a State Dewatering Permit and a dewatering plan approved by Aurora Water Environmental Inspections Division per Section 4.06 of these regulations.**

## **SECTION 9.00 PIPE BEDDING, BACKFILLING AND COMPACTION**

- 9.01 General
- 9.02 Granular Bedding Material
- 9.03 Compacting Granular Bedding
- 9.04 Compaction of Ordinary Backfill Material within the Bedding Section
- 9.05 Classes of Bedding
- 9.06 Ordinary Backfill Material
- 9.07 Select Backfill Material
- 9.08 Compaction Testing
- 9.09 Maintenance of Backfill
- 9.10 Construction Site Restoration

## SECTION 9.00 PIPE BEDDING, BACKFILLING AND COMPACTION

### 9.01 General

The minimum class of bedding shall be determined by the application for the type of pipe specified. The Contractor may select a higher class bedding at his option. If he/she does not comply with the minimum bedding requirements, he/she must use the next higher class of bedding at no cost to the City.

Backfilling and compaction shall be performed when practicable after completion of all necessary inspections, or when authorized by the Engineer. The total length of open trenches shall not exceed three hundred feet (300') at any time. Jetting or ponding as a means of compaction shall not be allowed. Backfill material above the optimum moisture content shall not be allowed in the trench until it has been properly dried to optimum moisture. Only soil with the proper moisture content shall be allowed as backfill material. Any procedure, required by the Engineer to process backfill material, shall be the Contractor's responsibility. Unless otherwise specified, the Contractor at his/her expense shall properly dispose of all excess backfill off the right-of-way and public property. Special care shall be taken to ensure proper compaction around valve boxes and manholes.

In general, the backfill material shall consist of material excavated from the trench except rubbish, frozen material, broken pavement, other debris, stones greater than three inches (3") in diameter, organic muck, or other materials considered deleterious by the Engineer, or is not in conformance with the Roadway Design and Construction Specifications, latest edition. When in the opinion of the Engineer, the excavated material is not satisfactory for use as backfill, or whenever there is a shortage of satisfactory backfill material, the Contractor shall furnish all necessary suitable backfill material and shall dispose of the condemned excavated material at the Contractor's expense.

### 9.02 Granular Bedding Material

The bedding and pipe zone material shall be clean, free draining well-graded sand or squeegee sand and shall conform to the following limits when tested by means of laboratory sieves:

<u>Well Graded Sand</u>	
<u>Sieve Size</u>	<u>Total Percent Passing By Weight</u>
3/8 inch	100
No. 4	70-100
No. 8	36-93
No. 16	20-80
No. 30	8-65
No. 50	2-30
No. 100	1-10
No. 200	0-5

#### Angular Squeegee Sand

<u>Sieve Size</u>	<u>Total Percent Passing By Weight</u>
3/8 inch	100
No. 200	0-3

#### 3/4" Coarse Aggregate (#67)

<u>Sieve Size</u>	<u>Total Percent Passing By Weight</u>
1 inch	100
3/4 inch	90-100
3/8 inch	20-55
#4	0-10
#8	0-5

Approved bedding and pipe zone material shall be stockpiled on the jobsite to be used in the event natural materials become unsatisfactory. Aurora Water reserves the right to require the use of specified bedding in the pipe zone at any time.

### **9.03 Compacting Granular Bedding**

Granular bedding material shall be deposited in layers not exceeding twelve inches (12") in loose measured thickness. Each layer shall then be compacted by surface or internal vibrators, hand or power tampers, or other suitable compaction equipment. Each layer shall be compacted to the required degree of compaction before the placement of subsequent layers. Layer thickness shall be reduced if the compaction equipment and compaction effort does not provide the required degree of compaction. The material shall have a minimum compaction of seventy percent (70%) relative density as determined by ASTM D-4253. Layer thickness may be increased only when sufficient compaction tests are provided to the Engineer which verifies a piece of equipment can compact to a depth exceeding twelve inches (12"). The material shall be compacted to a minimum of ninety-five percent (95%) of maximum dry density as determined by AASHTO T180 or, seventy percent (70%) of relative density as determined by ASTM D-4253, whichever is greater. The time and depth of testing are at the discretion of the Inspector and shall be in accordance with these specifications

### **9.04 Compaction of Ordinary Backfill Material within the Bedding Section**

Ordinary backfill material shall be deposited in layers not exceeding twelve inches (12") in loose measured thickness. Each layer shall then be compacted by surface or internal vibrators, hand or power tampers, or other suitable compaction equipment. Layer thickness may be increased only if Contractor can demonstrate that sufficient compaction can be achieved with the methods and equipment provided by the Contractor and when sufficient compaction tests are provided to the Engineer which verifies a piece of equipment can compact to a depth exceeding twelve inches (12"). Each layer shall be compacted to the required degree of compaction before the placement of subsequent

layers. Layer thickness shall be reduced if the compaction equipment and compaction effort does not provide the required degree of compaction. Ordinary backfill shall be placed from one foot (1') above the pipe to the surface, except as required in Section 9.03. Compacted backfill shall be placed to a minimum depth of thirty inches (30") above the top of the pipe before a vibratory roller or a compacting hammer is used over the pipe. Ordinary backfill in Public Right-of-Way shall be compacted as follows:

<b><u>Soil Type</u></b>	<b><u>Compaction</u></b>	<b><u>Moisture Content</u></b>
A-1 thru A-5	95% max. dry density <sup>1</sup>	±2 percent optimum moisture content
A-6 & A-7	95% max. dry density <sup>2</sup>	0 to +2 percent moisture content

The backfill may be tested at any depth and shall be properly compacted at all depths. The time and depth of testing shall be at the discretion of the Inspector and in accordance with these specifications.

Compacted ordinary backfill material consisting of A1 to A5 soils shall have a minimum compaction of ninety-five percent (95%) of the maximum dry density determined by AASHTO T180 at plus/minus two percent (2%) of optimum moisture content. A6 and A7 soils shall have a minimum compaction of ninety-five percent (95%) of maximum dry density determined by AASHTO T99 at zero (0) to two percent (2%) of optimum moisture content.

## **9.05 Classes of Bedding (Methods)**

### **9.05.1 Class A Bedding**

(Concrete Cradle) Class A bedding shall be defined as the method of bedding in which the lower half of the pipe is set in reinforced concrete. The minimum thickness of concrete under the lowest part of the conduit shall be one quarter (1/4) of the outside pipe diameter, but not less than six inches (6"). The concrete shall extend upward around the pipe to the spring line of the pipe barrel. The concrete cradle shall be a minimum of six inches (6") thick in all places. Reinforcement shall be #4 deformed bars twelve inches (12") laterally and longitudinally on centers in the middle of the slab. Backfill materials shall be hand compacted to a minimum depth of one foot (1') above the pipe.

### **9.05.2 Class B Bedding**

Class B bedding shall be defined as the method of bedding in which the pipe is set on compacted granular bedding material. The trench shall be excavated to a depth below the established grade equal to 1/4 of the outside diameter, but not less than six inches (6"). In rock excavation, the minimum depth shall be six inches (6"). Granular bedding material shall be placed and compacted under the pipe and around the sides of the pipe

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<sup>1</sup> As determined by AASHTO T180

<sup>2</sup> As determined by AASHTO T99

to spring line. The granular bedding material shall be consolidated and compacted as required in these specifications.

### **9.05.3 Class B Alternate Bedding**

The same requirements shall apply as in Class B bedding but granular material shall be placed to a depth of one foot (1') above the pipe for all Sanitary Sewer PVC, flexible Storm Sewer pipe installations and all water main pipe. This method may also be used at the Contractor's option or shall be required by the Inspector if the Contractor cannot meet the compaction requirements using ordinary backfill material to one foot (1') above the pipe.

### **9.05.4 Class C Bedding**

Class C bedding shall be defined as the method of bedding in which the pipe is set on compacted granular bedding material supporting the lower quadrant of the pipe barrel. The trench shall be excavated to a depth below the established grade equal to one eighth ( $\frac{1}{8}$ ) of the outside pipe diameter, but not less than six inches (6"). Compacted granular material shall be placed under the pipe and around the sides of the pipe to a minimum of one sixth ( $\frac{1}{6}$ ) of the outside pipe diameter from the bottom of the pipe barrel. The granular bedding material shall be consolidated and compacted as required in these specifications. Ordinary backfill material shall be compacted to one foot (1') above the pipe as required per these specifications.

## **9.06 Ordinary Backfill Material**

Ordinary backfill material shall be material excavated from pipe line trenches on the site which is free from frozen materials, large amounts of organic material or other objectionable materials. Clays and similar materials with a plasticity index greater than twenty (20) and a dry density less than ninety-five (95) pounds per cubic foot in roadways shall not be considered suitable for backfilling within one foot (1') of the pipe.

## **9.07 Select Backfill Material**

Select backfill shall be used under roadways whenever ground water is encountered within three feet (3') of the surface. Select backfill shall be road base crushed or pit run gravel all of which passes a one inch (1") sieve and not more than thirty percent (30%) passes a No. 40 sieve.

## **9.08 Compaction Testing**

The compaction of the bedding and the backfill shall be tested at a rate of at least one (1) test per two hundred (200) cu. yd. of fill material or portions thereof and at least one (1) test per two hundred fifty (250) linear feet, whichever controls. The testing shall be at varying depths and locations. The Inspector may require additional testing around manholes and valve boxes. The Contractor shall also have one test provided to the City for every three (3) water or sanitary service lines.

Initial test results shall be submitted by the Contractor to Materials Testing Laboratory within the next City working day. Compaction testing shall be performed by a qualified technician who works under the direct supervision of a Licensed Professional Engineer. Final soils compaction reports shall be prepared and signed by a Licensed Professional

Engineer who is licensed in the State of Colorado and is qualified to prepare such reports. Reports shall be submitted to the C.O.A. Materials Testing Laboratory for review and approval within one (1) week of the test. All reports shall identify the appropriate utility permit number and shall include a map showing the location of tests taken both vertically and horizontally along the utility trench. Compaction testing on private infrastructure shall be performed by private engineering or geotechnical firms at the Contractor/Developer's expense and submitted to the C.O.A. Materials Testing Laboratory for review and approval prior to paving.

## **9.09 Maintenance of Backfill**

All backfill during construction shall be maintained to the satisfaction of the Engineer. Access across trenches for driveways and streets shall be maintained free of hazards to traffic or pedestrians.

## **9.10 Construction Site Restoration**

Upon completion of backfilling, the surface shall be restored fully to a condition equal to or better than what existed before construction. Final grades in unimproved areas shall match existing grades at construction limits without producing drainage problems. Restoration of native grasses per City of Aurora Rules and Regulations Regarding Storm water Discharges Associated with Construction Activities shall be necessary unless otherwise specified. Restoration of sod, shrubs, trees and other landscaping shall be at the Contractor's expense. All sod, shrubs, trees and other landscaping shall be replaced with material of equal or better size and quality. Reseeding of sodded areas shall not be allowed unless specified. All work within improved areas shall be in accordance with these specifications and City of Aurora Rules and Regulations Regarding Storm water Discharges Associated with Construction Activities. The cost of replacement work and removal of all debris from the site of the work shall be at the expense of the Contractor. Patch back of paved streets shall be in conformance with the Roadway Design and Construction Specifications, latest edition.



## **SECTION 10.00 MANHOLES, VAULTS AND INLETS**

- 10.01 Materials
- 10.02 Construction
- 10.03 Manhole Bases and Channels
- 10.04 Horizontal Joints
- 10.05 Existing Manholes
- 10.06 Water System Manholes and Vaults
- 10.07 Sanitary Sewer System Manholes
- 10.08 Storm Sewer System Manholes and Inlets
- 10.09 Reference Markers

## **SECTION 10.00 MANHOLES, VAULTS AND INLETS**

### **10.01 Materials**

The materials to be used in the construction of manholes shall conform to the following requirements.

#### **10.01.1 Cones**

All cones shall be eccentric and conform to ASTM C-478.

#### **10.01.2 Precast Manholes and Vaults**

Precast manholes and vaults must be manufactured in conformance with ASTM Designation C-478. The internal diameter of the manhole barrel shall be as specified on the approved plans.

#### **10.01.3 Precast Manholes Inlets and Vault Bases**

Precast channels, benches and inverts in manholes, storm sewer inlets and vault bases are prohibited for public sanitary sewer and storm sewer systems without prior approval. The channels, benches and inverts shall be cast-in-place after installation of the base as applicable. Private sanitary and storm facilities are allowed to utilize pre-cast inlets and manhole bases with channels and inverts. Precast manhole bases shall be constructed with reinforcement in accordance with ASTM C-478. A six (6") compacted layer of three-quarter inch (3/4") coarse aggregate (#67) shall be provided below pre-cast structures. See latest edition of pre-approved materials list as provided by Public Works for materials allowed.

#### **10.01.4 Cast in Place Manholes**

Cast in place manhole bases with the channels, benches and inverts are allowed per the approved products list. Barrel sections set to final grade shall be precast.

#### **10.01.5 Cast in Place Vaults**

Cast in place vaults require structural design by a Colorado Licensed Professional Engineer to meet AASHTO HS-20 requirements, or be in conformance with CDOT M-Standards. If the depth of the vault exceeds the maximum listed in the CDOT M-Standards, then a structural design is required.

#### **10.01.6 Brick**

Brick manholes are not allowed.

#### **10.01.7 Concrete**

All concrete work shall conform to the requirements of the City of Aurora Roadway Design Standards and Specifications, latest edition.

#### **10.01.8 Manhole Steps**

Sanitary sewer manholes and storm sewer manholes, storm sewer inlets and vaults require manhole steps per these specifications.

### 10.01.9 Frames and Covers

Manhole frames and covers shall conform to the table below. The manhole frame and cover shall be as shown in the standard details. The cover shall be machined to fit the frame to exclude surface water and be level with the top of the frame. Covers shall have no more than one lifting slot which must not extend beyond the lip of the frame.

**Table for Frame and Covers**

Type of Facility	Description	Size of Frame and Cover
Water	1½" and 2" Meter Vault	24"
	3" and Larger Meter Vault	24"
	Butterfly Valve Vault	24"
	PRV or Check Valve Vault	36" with 22" Removable Lid
Sanitary Sewer	21" and Smaller Pipes	24"
	24" and Larger Pipes	30"
Storm Sewer	60" and Smaller Pipes	24"
	66" and Larger pipes	30"

The frame shall be secured through placement of mortar. A 6x6 inch concrete collar shall be placed around the frame for manholes not located within a pavement section.

Manholes placed within areas designated by Aurora Water as "restricted access", shall have a locking lid with the rim permanently bolted to the manhole cone section. See Appendix B, Approved Materials List, for approved products and manufacturers.

### 10.01.10 Flexible Joint sealing Compound

Flexible joint sealing compound material shall be used in all concrete barrel and base joints. Sealing compounds shall conform to Federal Specifications SS-S-210 and shall remain pliable to -20 degrees Fahrenheit and shall not become excessively pliable at +120 degrees Fahrenheit. See Appendix B: Approved Materials List for approved products and manufacturers.

In locations of high groundwater joints between precast manhole sections shall consist of double O-ring rubber gaskets conforming to ASTM C443 or butyl rubber gaskets conforming to AASHTO M198. A six inch (6") minimum width of butyl rubber coating shall be applied on exterior of manhole at each joint to prevent leakage. See Appendix B, Approved Materials List, for approved products and manufacturers.

### 10.01.11 Job Mixed Grout

Job mixed grout shall be one part Portland Cement conforming to ASTM C207, one part sand conforming to ASTM C144, and one part shrinkage correcting aggregate. See Appendix B, Approved Materials List for accepted manufacturers.

### **10.01.12 Hydrogen Sulfide Resistance**

All sanitary sewer manholes on mains larger than twelve inches (12") in diameter shall be constructed with, or lined with, hydrogen sulfide resistant materials. Aurora Water Engineering may require lining on smaller sized systems with high probabilities of hydrogen sulfide generation. Hydrogen sulfide resistant lining shall be applied to a minimum thickness per manufacture's recommendations. All coatings must be holiday tested for proper installation by a third party NASSCO certified tester. Testing must be in accordance to the manufacturer's recommendations. See Appendix B: Approved Materials List for approved products and manufacturers.

### **10.02 Construction**

Manholes shall be installed and constructed in conformance with ASTM C891. They shall be constructed at the locations and elevations indicated on the drawings. The manhole barrels shall be watertight at all joints including the base. Manhole bases shall be installed level and if necessary through the use crushed rock as a leveling course.

All manholes six and one half feet (6½') deep measured from the bench to the top of the cone shall be constructed with an eccentric cone. All manholes less than six and one half feet (6½') deep shall be constructed with a flat top over the outlet invert per Standard Detail #101 unless otherwise stated on the plans or directed by the Engineer in writing. Minimum clearance from any block-out or core drilled opening to the top of a barrel section without special design is three inches (3"). The top of cone or top of flat lid section shall not extend to a point closer than eight inches (8") and no more than twenty inches (20") from the top of the manhole cover. Precast concrete adjustment rings shall be used on top of the cone or flat lid to support and adjust the manhole frame to the required final grade.

Flexible joint sealing compound conforming to these specifications shall be applied to all manhole joints to include, but not limited to, all precast vault joints, between concrete manhole grade rings as well as between manhole frames and the top of the manhole. The application of the priming compound and the sealing compound shall be accomplished in strict conformance with the manufacturer's instructions. The joint materials shall conform to the approximate manufactured shape at the time of installation. Any materials not conforming shall be rejected and not used. The joint materials shall not be stretched or in any way distorted.

The internal diameter of all manholes shall be maintained from the manhole base to a distance of not more than five feet (5') below finished grades per Standard Detail 101. From the point five feet (5') below finished grade to the surface the manhole barrel shall be tapered to the appropriate frame and cover manhole diameter for the appropriate system. Manhole steps are not allowed in the chimney.

Manholes placed within newly constructed areas shall be placed to final grade prior to the placement of the final lift of asphalt. Cast iron riser rings are not allowed for adjustment of new manholes. Submittal and approval of manhole riser rings shall be required to ensure conformance with City of Aurora standards.

### **10.03 Manhole Bases and Channels**

Manhole bases, unless noted otherwise on the drawings, shall be constructed as shown on the standard manhole detail drawings. All manhole bases cast in the City of Aurora must be placed using an iron manhole forming ring sized for the appropriate sized manhole base. In the event the subgrade has been over excavated, granular bedding material shall be used and compacted per these specifications and approved by the Inspector to bring the subgrade to final elevation.

Changes in direction of flow through the manhole shall be made with a smooth curved channel having as large a radius as possible. The change in size of channels shall be made gradually and evenly and shall be formed directly in the concrete. In addition, the grade and pipe curvature of the primary channel shall be maintained throughout the length of the channel. The floor of the manhole, outside the channel, shall be finished with a broomed surface and shall be slightly sloped to allow a worker to comfortably stand on the bench. The concrete depth for the channel shall measure no less than four inches (4") thick at the flow line.

The minimum thickness of the base shall not be less than eight inches (8") under the invert of the manhole channel for a cast-in-place base. Manhole base diameters shall be two feet (2') greater than the outside diameter of the manhole barrel section. The walls of the base shall be no less than twelve inches (12") thick. The joint between the manhole base and the lowest pre-cast section shall be grouted, outside, with a grout fillet.

### **10.04 Horizontal Joints**

Flexible plastic joint sealing compound in conformance with these specifications shall be applied to all manhole joints. The application of the priming compound and the sealing compound shall be accomplished in strict conformance with the manufacturer's instructions. The joint materials shall conform to the approximate manufactured shape at the time of installation. Any materials not conforming shall be rejected and not used. The joint materials shall not be stretched or in any other way distorted.

Manhole joints shall be smooth finished with non-shrink grouting material per these specifications.

Sanitary and storm sewer manholes constructed in areas of high groundwater level shall be constructed in accordance with these specifications and Standard Detail #101.

### **10.05 Existing Manholes**

All penetrations to an existing manhole shall be accomplished by core drilling and installing Link Seal or approved equivalent, then grouting around inside and outside of the penetration. The existing concrete foundation bench shall be chipped to the cross-section of the new pipe to form a smooth continuous invert similar to what would be formed in a new concrete base. Cement grout shall be used as necessary to finish the new invert smoothly and to seal the new line so the junction is watertight. All manhole steps and landing platforms' access doors shall be aligned for the entire depth of the manhole, if present.

Within existing paved areas, manhole frames and covers can be adjusted up to three inches (3") vertically with cast iron riser rings. Concrete rings are required for adjustments greater than three inches (3"), as long as the final rim elevation is no further than twenty-four inches (24") from the first step, if steps are present.

### **10.06 Water System Manholes and Vaults**

Manholes shall be constructed to allow for operation of all valves from above ground with a four and one half foot (4½') valve key. All valve vaults shall be designed adequately to house the valves and fittings therein contained and to withstand all external loadings imposed by earth, thrust, and AASHTO HS-20 loading. Vaults shall be furnished with removable roof slabs or manholes of sufficient size to allow removal of all valves and fittings and shall be fitted with air vents open to the atmosphere. Vaults shall be constructed according to the approved drawings and these specifications.

### **10.07 Sanitary Sewer System Manholes**

Service lines shall not empty directly into a manhole unless the manhole has been specifically and exclusively constructed for the service line. Clean-outs shall not, under any circumstance, be allowed in place of a manhole. Manhole spacing, sizing criteria and acceptable drops through manholes shall conform to these specifications.

The use of external or internal drop manholes for sanitary systems shall only be allowed on a case-by-case basis due to upstream conflicts. Prior to approval of a drop manhole, the Design Engineer must provide alternatives for review and consideration by Aurora Water Engineering. External drop manholes may be approved by the Aurora Water when the incoming flow-line invert elevation is eighteen inches (18") or greater, above the downstream/out flow-line invert elevation.

Sewer pipe connections to existing manholes, if there is no existing pipe stubbed out, shall be made so the finished work shall conform as nearly as practicable to the essential requirements specified for new manholes. The Contractor shall take precautionary measures to ensure no tools, concrete, dirt, or debris of any kind is allowed to fall into the channel of the existing manhole by placing a protective cover over the bench. The Contractor shall be responsible for any cleaning or removal of debris from the downstream sewer as a result of his/her work.

### **10.08 Storm Sewer System Manholes and Inlets**

Inlets shall be constructed at the locations and to the elevations specified on the drawings. Construction shall be in accordance with the standard drawings for Curb Opening Inlet. The edge of the access opening shall be located no more than eighteen inches (18") from the inside face of the outlet pipe. In no case shall outfall pipes be placed vertically in the floor of the inlet. Pipe penetrations may not be through the corners of a precast inlet. Pre-cast inlets for public storm sewer systems are not allowed without prior authorization.

Drop manholes are allowed, however require special design if velocities exceed eighteen feet (18') per second. Drop manholes exceeding thirty inches (30") of vertical drop require approval on a case-by-case basis.

Roadway Edge Drain Connection to Type R Inlets shall conform with these specifications as shown in the standard details.

### **10.09 Reference Markers**

Whenever a manhole is outside a traveled street or walkway, a reference marker shall be installed per these specifications and placed within three feet (3') of the appurtenance.

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## **SECTION 11.00 WATER PIPE INSTALLATION**

- 11.01 General
- 11.02 Progression of Work
- 11.03 Alignment
- 11.04 Excavation, Bedding and Backfilling
- 11.05 Fittings and Specials
- 11.06 Wet Taps
- 11.07 Rubber Gasket Joints
- 11.08 Cradles and Encasements for Utility Crossings
- 11.09 Thrust Restraint
- 11.10 Thrust Blocks
- 11.11 Cathodic Protection
- 11.12 Disinfection of Water Lines
- 11.13 Flushing the Line
- 11.14 Pressure Test

## **SECTION 11.00 WATER PIPE INSTALLATION**

### **11.01 General**

Water lines shall be installed according to the following specifications. The more stringent requirements shall govern in case of a conflict.

- American Water Works Association Standard C200
- American Water Works Association Standard C600
- American Water Works Association Standard C900
- American Water Works Association Standard C905
- The City of Aurora Standards and Specifications Regarding Water, Sanitary Sewer and Storm Drainage Infrastructure, latest edition
- The Water Works Manufacturer Recommendations.

### **11.02 Progression of Work**

Pipe shall be laid accurately to the grade and alignment specified on the drawings. Blocking or wedging of the pipe to achieve proper positioning and grade shall not be permitted, except where required for the proper construction of cradles or encasement. When pipe placement is not in progress, all open ends of pipe shall be closed by a mechanical watertight plug. Plywood shall not be permitted as a substitute. The cutting of pipe for insertion of fittings or closure pieces shall be done neatly without damaging the pipe coating or lining and so as to leave a smooth end at right angles to the long axis of the pipe. Flame cutting of pipe shall not be allowed. The Contractor shall provide strutting and bracing of steel pipe to avoid damage and excessive deflection as required by the Engineer. Supports shall be of adequate strength with ends conforming to the curvature of the pipe. Ends shall be sufficiently padded to prevent damage to the lining.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFICATION OF AFFECTED USERS IF HIS/HER WORK CAUSES ANY DISRUPTION IN SERVICE.

### **11.03 Alignment**

All pipes shall be constructed to the lines, grades and elevations shown on the approved drawings. The minimum cover on all water mains shall be four and one half feet (4½'). Water mains sixteen inches (16") in diameter and larger shall be strictly laid on approved grades to allow proper installation of air relief and air vacuum valves and blow-off valves. All pipes shall be laid to straight lines as staked between specified and otherwise authorized angles, bends or points of tangency of horizontal or vertical curves.

DEFLECTION AT FIELD JOINTS SHALL NOT EXCEED THE MAXIMUM DEFLECTION RECOMMENDED BY THE PIPE MANUFACTURER.

### **11.04 Excavation, Bedding and Backfill**

Excavation, bedding and backfilling shall be in accordance to Section 8 and Section 9 of these specifications.

### **11.05 Fittings and Specials**

Fittings and specials shall be installed as detailed on the drawings and shall be properly anchored against thrust and uplift forces.

### **11.06 Wet Taps**

Wet taps are performed on live water mains by Aurora Water for the purpose of water main extensions, fire hydrant laterals, private fire suppression lines, and water services larger than two inches (2"). Contractor is responsible for paying the wet tap fee and scheduling the tap at least two (2) business days in advance with Customer Service at 303-326-8645. Wet taps will only be performed if the ambient temperature is a minimum of thirty-two degrees (32°) Fahrenheit and rising.

Excavation for wet tap shall have shielding or shoring on all sides including headwall and rear of excavation. Excavation area inside the shoring or shielding shall extend three (3) feet behind the pipe with headwall protection.

When multiple utility conflicts prevent a shoring box from being used, hydraulic speed shoring is acceptable. Shielding or shoring shall extend a minimum of eighteen inches (18") above finish grade.

For Bolt-on saddles for tapping DIP and PVC mains, excavation area inside the shoring or shielding shall extend three feet (3') behind the pipe, seven feet (7') minimum on the wet tap side of the pipe, and be a minimum of five feet (5') in width. A minimum of two feet (2') feet of clear area below the pipe is required. For weld-on applications on steel pipe, excavation area inside the shoring or shielding shall extend seven feet (7') minimum on the wet tap side of the pipe and be a minimum of six feet (6') in width. These taps may require material to be removed from the back side of the pipe for placement of concrete thrust blocks as necessary. Minimum clear area beneath the pipe for weld-on applications shall be two feet (2').

Contractor shall provide a ladder for entry and exit extending a minimum of three feet (3') vertically above existing grade.

If Contractor fails to meet the above criteria, Aurora Water personnel will not enter the excavation and wet tap will need to be re-scheduled.

### **11.07 Rubber Gasket Joint**

Rubber gasket joints shall be according to ANSI/AWWA C111/A21.11 and these specifications.

#### **11.07.1 Lubricant**

The lubricant shall be suitable for lubricating the parts of the joint in assembly. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. The lubricant shall be nontoxic, shall not support the growth of bacteria, and shall have no deteriorating effects on the gasket material. It shall not impart taste or odor to

water in the pipe. The lubricant containers shall be labeled with the trade name or trademarks and the pipe manufacturer's name. The lubricant shall be supplied by the pipe manufacturer and approved by the Inspector.

#### **11.07.2 Gaskets**

Gaskets shall always be protected from damage and contamination. Gaskets displaying any imperfection in manufacturing, any damage, or any contamination shall not be used.

#### **11.07.3 Installation**

All surfaces in contact with the rubber gasket shall be thoroughly cleaned to be free of all visible contamination immediately prior to installation. All contaminants, excess coating, rust or any other foreign material shall be removed from the gasket groove and the spigot end.

### **11.08 Cradles and Encasements for Utility Crossings**

Temporary supports consisting of concrete blocks or bricks shall be used to support pipe in place before placing concrete for cradles or encasement. Not more than two (2) supports shall be used for each pipe length, one (1) beside the shoulder of the bell and the other near the spigot end. Water main shall be double-wrapped with polyethylene tubing within cradles or encasements and reinforcing steel bars shall not be allowed to be in contact with the pipe. Polyethylene wrap in tube or sheet form for piping encasement shall be manufactured of virgin polyethylene material conforming to the requirements of ANSI/ASTM Standard Specification D1248.

#### **11.08.1 Storm Sewer Crossing over Water or Sanitary Sewer**

A minimum clearance of eighteen inches (18") is required whenever a storm sewer crosses over a water or sanitary sewer main. If eighteen inches (18") of clearance cannot be maintained, a concrete cradle shall be installed per these specifications. In no case shall vertical clearance between storm sewer pipe and sanitary sewer or water pipe be less than six inches (6"). In cases where vertical clearance is less than eighteen inches (18") insulation may be required as determined by Aurora Water Engineering.

#### **11.08.2 Water Crossing over Sanitary Sewer**

A minimum clearance of twenty-four inches (24") is required whenever a water main crosses over a sanitary sewer. Concrete encasement of the sanitary sewer shall be required if the clearance is less than twenty-four inches (24") and shall be installed per these specifications. Encasement shall extend ten feet (10') either side of the crossing for a total length of twenty feet (20').

#### **11.08.3 Sanitary Sewer Crossing over Water**

Sanitary mains and services are not allowed to cross over water lines without the approval of the Engineer and site specific design of the crossing.

#### **11.08.4 Water or Sanitary Sewer over Storm Sewer**

Concrete cradles or encasements are not required whenever a water main or sanitary sewer main crosses over a storm sewer unless required by the Engineer.

### **11.09 Thrust Restraint**

Water main restraint shall be required at all fittings requiring protection from unbalanced thrust forces per these specifications. Specifically, vertical and horizontal bends or offsets, dead-ends, bulkheads, tees, three inches (3") and larger domestic connections, branches, fire protection lines and fire hydrants. Fire hydrant laterals and fire suppression lines are required to be restrained for their entire length. Allowable restraint products are listed in Appendix B: Approved Material List.

### **11.10 Thrust Blocks**

In addition to joint restraint, all bends, tees, fire hydrants, main wet taps, plugs and plugs with blow-offs at dead-ends, shall require protection from thrust using thrust blocks. Poured concrete thrust block per these specifications must be cured twenty-four (24) hours before backfill unless otherwise permitted by the Engineer. Thrust blocks may be backfilled prior to twenty-four (24) hours of cure time if high-early strength concrete is used which can attain strength of two thousand five hundred (2,500) psi within four (4) hours after placement. A double-wrapped polyethylene barrier shall be required at all points where concrete is in direct contact with the pipe and/or fittings. This requirement applies to all pipe materials.

Concrete thrust blocks shall be sized for the internal pressure of the pipeline and the load bearing capacity of the soil. The internal water pressure used for design shall be two hundred (200) psi minimum for water mains smaller than sixteen inches (16") in diameter. The static line pressure plus one hundred fifty (150) psi shall be used for water mains sixteen inches (16") or larger. In no case shall the internal design pressure for thrust restraint be less than surge pressure as recommended in the AWWA Manual M11. Concrete thrust blocks shall be Type II (or IIA). Thrust blocks shall always bear against undisturbed earth. If in the opinion of the Engineer, the soil bearing capacity is not sufficient to provide adequate restraint (based on a minimum soil bearing capacity of two thousand (2,000) psi), bearing area shall be increased to a size which shall ensure adequate restraint.

Gravity blocks are required at all downward vertical bends.

### **11.11 Cathodic Protection**

Isolation shall be provided between dissimilar metals in all cases except air vacuum assemblies. Ductile iron pipe and all fittings shall be wrapped in polyethylene tubing according to ANSI/AWWA C105/A21.50 and these specifications to prevent corrosion. Pipe shall be double-wrapped within encasements or cradles. Corrosion Protection for all water mains shall be according to Section 20 of these specifications.

### **11.12 Disinfection of Water Lines**

All potable water lines shall be disinfected prior to being placed into service or tapped. All labor, equipment, and materials necessary to disinfect new water lines is the Contractor's responsibility. Re-chlorination shall be required if the main is not tested within thirty (30) days of initial filling or is not placed into service within thirty (30) days of

testing. Disinfection shall be accomplished by the Chlorine Concentration Test followed by the Bacteria Test, as hereafter specified. The City of Aurora Water Quality Laboratory or an authorized representative will conduct all chlorine and bacteria testing. Chlorination shall be performed according to AWWA C651-14 and these specifications. A maximum of three (3) tests are allowed to be performed on any section of main. Upon the third failing test, the pipe is required to be cleaned by a mechanical means. The Aurora Water Department reserves the right to require removal and replacement of the pipe in the event of continued failing test results.

**Only City of Aurora Water Division Personnel shall operate valves in contact with the City of Aurora water system. Any other person who operates a valve in contact with potable water is subject to fines under the City of Aurora Municipal Code.**

#### **11.12.1 Chlorine Concentration Test**

The Chlorine concentration shall be tested at accessible locations and as required by Aurora Water personnel. This includes, but is not limited to, fire hydrants, blow-offs, and stub lines. Chlorine shall be tested by either Amperometric Titration or N,N Diethyl-1,4 Phenylenediamine Sulfate (DPD) Test. Orthotolidine colorimetric testing is not an acceptable method of testing the chlorine concentration.

#### **11.12.2 Mechanical Disinfection of Pipe**

All pipe segments must be spray-disinfected or swabbed with a minimum one percent (1%) solution of chlorine immediately prior to being installed in accordance with AWWA C651-14, Section 4.8.6, regardless of whether dirt has entered the pipe.

#### **11.12.3 Tablet Method**

Calcium hypochlorite tablets shall be used for chlorination when contamination control has been exercised during installation of the pipe according to AWWA C651-14, Section 4.8. The tablet method shall not be used when trench water or foreign materials have entered the water line. Installed water mains shall not be flushed before chlorination. The tablets shall be secured to the top inside surface of the pipe wall by use of an adhesive meeting the requirements of NSF/ANSI 61. Adhesive shall only be applied to the broad side of each tablet. Tablets shall be attached before the pipe section is placed in the trench, and their locations marked on the outside of the pipe to ensure placement in an upright orientation. The use of Calcium hypochlorite intended for swimming pool disinfection is prohibited.

##### **11.12.3.1 Number of Tablets**

A sufficient number of calcium hypochlorite tablets must be placed in order to provide a minimum free chlorine concentration of 50 mg/L after the pipe has been filled with potable water. The following formula or table will provide the number of tablets for this required concentration assuming three and one fourth (3¼) grams available chlorine per five (5) gram tablet under normal conditions.

Equation for number of tablets:

$$\text{Tablets} = 0.0012d^2L$$

Where  $d$  is the diameter of the pipe and  $L$  is the length of the pipe section.

Number of Tablets per Pipe Section

Length of Section(feet)	Diameter of Pipe				
	4"	6"	8"	12"	16"
13 or less	2	2	2	5	9
18	2	3	4	6	12
20	2	3	4	7	14

#### 11.12.3.2 Filling the Line

The line shall be filled with potable water at a velocity no greater than one (1) ft/sec. If the potable water used for disinfection and pressure testing is not sourced from Aurora Water's existing distribution system, the supply vessel must be flushed and disinfected prior to its use to ensure that contaminants or debris are not introduced into the new pipe.

Chlorinated water must remain in the line for a minimum of twenty-four (24) hours. If the water temperature is less than (41°F (5°C)), the water shall remain in the pipe for at least forty-eight (48) hours. Heavily chlorinated water should not remain in the water line for prolonged periods of time in order to prevent damage to fittings and pipe linings. Furthermore, all necessary precautions must be made to prevent heavily chlorinated water from contaminating the existing distribution system. If such contamination occurs, the responsible party shall assume any and all responsibility for damage done by heavily chlorinated water entering existing facilities due to negligence on his/her part.

When the line is full, all valves, hydrants, and blow-offs shall be operated to ensure total chlorination. A residual concentration of at least twenty-five (25) mg/L at all test locations after the twenty-four (24) or forty-eight (48) hour chlorination time is required.

**Only City of Aurora Water Division Personnel shall operate valves in contact with the City of Aurora water system. Any other person who operates a valve in contact with potable water is subject to fines under the City of Aurora Municipal Code.**

#### 11.12.4 Continuous Feed Method

This method shall be used if flushing the water line before chlorination is necessary or if the tablet method fails.

##### 11.12.4.1 Application of Chlorine

Water from the existing distribution system shall be made to flow at a minimum rate of 3.0 ft/sec rate through the line to be disinfected. Chlorine is then pumped into the line at the source of fresh water at a rate resulting in a chlorine concentration of at least fifty (50) mg/L measured at all accessible locations and as required by the Aurora Water representative. All valves shall then be operated to insure total chlorination. After remaining in the line for twenty-four (24) hours, the chlorine residual shall be not less than ten (10) mg/L measured at all accessible locations and as required by the Aurora Water representative. The following table should meet these requirements under normal conditions.

Chlorine Required to Produce a Chlorine  
Concentration of 50 MG/L per 100 feet of Pipe

Pipe Size	100 Percent Chlorine (Lb.)	1 Percent Chlorine Solution (Gal)
6"	0.061	0.73
8"	0.108	1.30
10"	0.170	2.04
12"	0.240	2.88
16"	0.434	5.20

#### **11.12.5 Slug Method**

The slug method shall only be used for mains greater than twenty-four inch (24") diameter when the continuous feed or tablet methods are not practical, per AWWA Standard C651-14, Section 4.5.

##### **11.12.5.1 Chlorine Application**

Chlorine shall be applied continuously at a rate so all interior surfaces shall be exposed to a concentration of at least one hundred (100) milligrams per liter of chlorine for at least three (3) hours. All valves, fire hydrants and blow-offs shall be operated to ensure total chlorination.

##### **11.12.5.2 Flushing the Line**

The line shall be flushed until the chlorine residual at all required locations is less than one (1) mg/L or system residual. When discharging water during the flushing process, care shall be taken to prevent erosion or the killing of desirable vegetation during the flushing process, through the use of de-chlorination devices.

##### **11.12.6 Special Conditions**

Precautions shall be taken to avoid contamination when water mains are cut into or repaired. If water mains are cut into or repaired and there is no interruption of service, continuous feed or slug method may be used at the discretion of the Inspector. If significant service interruptions are imminent, the tablet method and twenty-four (24) hour chlorine contact time is allowed at the direction of the Inspector. Swabbing shall be required in the event of a service interruption and at final tie-ins. The Inspector will provide direction for proper and applicable procedures. When isolation of the section of line is possible, the continuous feed or slug method of chlorination shall be used, followed by and preceded by thorough flushing. The absolute minimum disinfection procedures shall include swabbing of all couplings, tapping sleeves and any other materials to be used with a five percent (5%) Sodium Hypochlorite solution (commercial Clorox or equivalent) or a three hundred fifty (350) mg/l available Chlorine solution made from Calcium Hypochlorite [One 5g tablet of Calcium Hypochlorite (70% available Chlorine) per ten (10) liters of water is equal to 350 mg/l of available Chlorine] immediately prior to being installed.



### **11.12.7 Bacteria Test**

Following chlorination, all treated water shall be thoroughly flushed from the pipe line at its extremities until the replacement water throughout its length shall, upon testing, be proved comparable in quality to the water served the public from the existing water supply system as approved by the City of Aurora. If there are undesirable bacteria present, the line shall be re-chlorinated and re-flushed as directed by the Inspector. It is ultimately the Contractor's responsibility to obtain a passing bacteria test. If acceptable results cannot be achieved, the Aurora Water Department reserves the right to require and replacement of the water line.

### **11.13 Flushing the Line**

When the chlorine test has been successfully completed, the water line shall be flushed until the chlorine residual is less than 2.5 mg/l. Water lines shall be flushed at a velocity of at least 2.5 feet per second through the line. Flushing shall be performed after the tablet method but before the continuous feed method. Flushing shall always be performed before bacteria testing. Flushing of lines shall be accomplished by using a fire hydrant pumper nozzle when possible. Both hydrant side nozzles must be used together for flushing when using a hydrant.

Contractor is responsible for any permitting required by Colorado Department of Public Health and Environment prior to flushing the line. The Contractor must follow flushing procedures outlined in the approved Storm Water Management Plan (SWMP). If no SWMP is required, Contractor shall flush water line per instructions of the Inspector.

### **11.14 Pressure Test**

The trench shall be backfilled after the pipe has been installed and visually inspected; the pipe shall then be filled with water and ALL AIR EXPELLED. If hydrants or blow-offs are not available at high points, the Contractor shall make the necessary taps at high points to expel the air and insert plugs after the air is expelled. The hydrostatic test pressure shall be two hundred (200 psi) at the lowest point in the line or section under testing and shall be maintained for at least two (2) hours. Water lines with butterfly valves shall be tested to a line pressure of one hundred fifty (150) psi. The Contractor shall apply pressure in a manner satisfactory to the Engineer and shall furnish all testing apparatus.

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

$$L = \frac{SD\sqrt{P}}{148000} \text{ for PVC and DIP lines.}$$

For mechanical joints and push-on joints; in which L is the allowable leakage, in gallons per hour; S is the length of the pipeline tested, in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test in pounds per square inch gauge.

For steel lines with gasketed joints and not welded, the leakage shall not exceed ten (10) gallons per inch diameter per twenty-four (24) hours per mile. Welded steel joint pipe shall provide zero leakage and shall conform with AWWA Manual M11,

Note: Any visible leaks despite the rate of leakage shall be repaired before acceptance. Newly constructed water lines shall not be left in service during acceptance procedures for the purpose of detecting possible leaks. It is the Contractor's responsibility to re-pressurize the main as necessary while isolating the new main from the existing distribution system.

## **SECTION 12.00 DUCTILE IRON (DIP) WATER LINE**

- 12.01 General
- 12.02 Diameter of Pipe
- 12.03 Pressure Class Design of Pipe
- 12.04 Grade of Iron
- 12.05 Pipe Lengths
- 12.06 Fittings and Specials
- 12.07 Field Joints
- 12.08 Protective Coatings
- 12.09 Cathodic Protection
- 12.10 Installation

## SECTION 12.00 DUCTILE IRON (DIP) WATER PIPE

### 12.01 General

All material, manufacturing operations, testing, inspection, and marking of ductile iron pipe shall be in conformance with the requirements of ANSI A21.51./AWWA C151. Ductile iron pipe shall be manufactured in the United States of America.

### 12.02 Diameter of Pipe

The diameter shown on the drawings shall mean the nominal inside diameter of the pipe.

### 12.03 Pressure Class Design of Pipe

The minimum pressure class for each section of the pipe line shall conform to ANSI A21.50/ AWWA C150. The following are the minimum allowable pressure classes of pipe which may be installed.

<u>Pipe Size</u>	<u>Pressure Class</u>
16" & smaller	Class 350
24" and larger	Class 250

#### 12.03.1 Thickness Class Design of Pipe

Ductile iron pipe must meet minimum ANSI/AWWA C150/A21.50 or C150/A21.51 for site-specific requirements. These specifications are for nominal wall thickness Class 52 or greater. The following table indicates the required thickness for each diameter of pipe.

Nominal Inside Diameter (in.)	Minimum Nominal Wall Thickness (in.)
4	.29
6	.31
8	.33
12	.37
16	.34
24	.38
30	.39
36	.43
42	.47
48	.51
54	.57

### 12.04 Grade of Iron

The grade of iron shall be 60-42-10 having a minimum tensile strength of sixty thousand (60,000) psi, minimum yield strength of forty-two thousand (42,000) psi, and a minimum elongation of ten percent (10%).

## **12.05 Pipe Lengths**

Pipe sections shall be furnished in not less than eighteen foot (18') nominal lengths with the exception of bends, reducers, closure pieces, and specials which may be of shorter lengths.

## **12.06 Fittings and Specials**

Fittings shall conform to ANSI A21.53/AWWA C153 and may be either cast iron or ductile iron. Fittings shall be Class 350 through twelve inch (12") lines, and Class 250 for sixteen inch (16") and larger lines. The designer shall furnish, for approval by the Engineer, details for all specials and other fittings not covered by ANSI A21.53/AWWA C153. All fittings shall be flanged, mechanical, or proprietary restrained joints.

## **12.07 Field Joints**

### **12.07.1 Flanged Joints**

Flanged joints shall conform to ANSI A21.10/AWWA C110.

### **12.07.2 Mechanical and Unrestrained Push-on Joints**

Mechanical and push-on joints shall conform to ANSI A21.11./AWWA C111. Unless otherwise specified, gaskets shall be Styrene Butadiene Rubber (SBR).

### **12.07.3 Bolts**

Bolts for flanged and mechanical joints shall be of weathering steel.

### **12.07.4 Push-on Restrained Joints**

Restrained push-on joints shall conform to ANSI A21.11/AWWA C111. Restrained joints shall be rated for the specified pressure rating of the pipe. Restrained joints shall be Flex-Ring, Field Flex-Ring, or Lok-Ring, or approved equal. Shop welded restrained joint pipe shall be used whenever the main is installed through a casing sleeve. Amarillo Fast-Grip gaskets, or domestically manufactured high visibility approved equal, are acceptable for direct bury push-on restrained joints for pipe twenty-four inches (24") in diameter and smaller. Unless otherwise specified, gaskets shall be SBR.

## **12.08 Protective Coatings**

The surface finish of all ductile iron pipe shall be factory coated and conform to the following sections.

### **12.08.1 Exterior**

The exterior coating shall be the standard outside bituminous coating as specified in ANSI A21.51./AWWA C151.

### **12.08.2 Interior**

Interior coating shall be a cement mortar coating as specified in ANSI A21.4/AWWA C104, unless otherwise specified.

## **12.09 Cathodic Protection**

Cathodic protection shall be required for all ductile iron mains larger than twelve inch (12") diameter according to these specifications. All diameters of ductile iron pipe and fittings shall be wrapped in V-Bio Enhanced polyethylene tubing to prevent corrosion. Polyethylene tubing, tape and installation shall meet the requirements of ANSI A21.5/AWWA C105, and these Specifications:

Thickness:        Fittings - Double wrap, each layer 8 mils (minimum)  
                         All Other - 8 mils (minimum)

Pigmentation:    White

Material:         V-Bio Enhanced polyethylene composed of virgin polyethylene.

Tape:              Polyvinyl chloride based with high tack adhesive.

Additional corrosion preventative measures or different pipe material may be required by Aurora Water Engineering where soil resistivity test results are less than one thousand (1,000) ohm-centimeters.

### **12.09.1 Installation of Polyethylene Tubing**

Polyethylene wrap in tube or sheet form for piping encasement must be manufactured from virgin polyethylene material conforming to the requirements of ANSI/ASTM Standard Specification D1248. Prior to installation of polyethylene tubes, clumps of mud or other contaminants shall be brushed off the pipe surface. Polyethylene tubes shall be installed according to ANSI A21.5 /AWWA C105 Method A. Method A requires the tubes to be overlapped one foot (1') and secured with tape, and the slack width to be taken up on top of the pipe and taped at the quarter points. All rips, punctures or other damage to the polyethylene shall be repaired with tape or with a short piece of tubing cut open, wrapped around the pipe and secured in place.

## **12.10 Installation**

Pipe shall be installed according to AWWA C600 and in accordance with any special requirements of the Engineer.

### **12.10.1 Trench Width**

The maximum trench width shall be the outside diameter of the pipe plus three feet (3'). Whenever the allowable trench width is exceeded, the Engineer shall be notified. Any improved bedding required by the Engineer shall be at the expense of the Contractor. Minimum clearance between the pipe and the trench wall shall be eight inches (8").

### **12.10.2 Bedding**

Pipe shall be bedded according to the bedding class noted on the plans. In no case will the bedding class be less than Class B Alternate. Compaction shall be according to these specifications.

## **SECTION 13.00 STEEL WATER LINE**

- 13.01 General
- 13.02 Diameter of Pipe
- 13.03 Wall Thickness Design of Pipe
- 13.04 Grade of Steel
- 13.05 Shop Test Pressure
- 13.06 Lining
- 13.07 Fittings and Specials
- 13.08 Field Joints
- 13.09 Installation
- 13.10 Cathodic Protection

## **SECTION 13.00 STEEL WATER PIPE**

### **13.01 General**

Steel pipe shall be installed as specified on project drawings and specifications. All material, manufacturing operations, testing, inspection and marking of steel pipe shall be in conformance with the requirements of AWWA C200, 203, 205, 206 and AWWA manual M11, *Steel Pipe – A Guide for Design and Installation*.

### **13.02 Diameter of Pipe**

The diameter indicated on the drawings shall mean the outside diameter of the pipe for sizes under thirty inches (30") and shall mean the inside diameter for sizes thirty inches (30") and larger.

### **13.03 Wall Thickness Design of Pipe**

The wall thickness of steel pipe shall be designed in accordance with the criteria established in AWWA manual, M11. The minimum wall thickness for each section of the pipe line shall conform to the thickness indicated on the drawings, and shall be subject to approval by the Engineer. The pipe with stiffeners, if any and the compacted soil in the bedding section shall form a structure of such stiffness so the vertical deflection of the embedded pipe shall not exceed two percent (2%) of the outside diameter of the pipe when subjected to the design loads.

### **13.04 Grade of Steel**

The grades of steel used in making pipe and fittings shall be those specified in AWWA C200.

### **13.05 Shop Test Pressure**

The minimum shop test pressure for pipe and fittings shall be in accordance with AWWA C200.

### **13.06 Lining**

All pipe will be concrete lined per AWWA specifications and handled so no cracks or damage is done to the pipe or lining. Any cracks more than 1/16" in width in the concrete lining will be repaired per AWWA Standards and the pipe manufacturers recommendations. On piping twenty-two inches (22") in diameter and larger, interior joints with gaps more than 1/16" will be hand grouted per AWWA recommendations. Piping smaller than twenty-two inches (22") in diameter will be grouted with the ball and burlap method according to AWWA specifications. All internal joints will be videotaped to verify the joint is adequately grouted.

### **13.07 Fittings and Specials**

Unless noted otherwise on the project drawings, fittings shall conform to the dimensions of AWWA C208 for service in piping systems for water works. Pipe used in fittings shall be of the same material and minimum thickness as the pipe. Fittings shall be equal in pressure design strength and shall have the same lining and coating as the abutting pipe.



Fittings, unless otherwise noted on the project drawings, shall be made of segmental welded sections, with bands to mate the type of joint or coupling used. Fittings which cannot be mechanically lined and coated shall be lined and coated by hand, using the same materials as those used for the pipe and in accordance with applicable AWWA Standards.

## **13.08 Field Joints**

### **13.08.1 General**

The following types of joints shall be acceptable: welded joints, mechanically coupled joints, or push-on joints. Flanged joints shall be acceptable for pipe on supports.

### **13.08.2 Welded Joints**

Welded steel pipe joints shall be as indicated in these specifications. For butt-welded joints, the end of the pipe section being laid shall be carefully aligned with the open end of the previously installed pipe, moved longitudinally until both pipe ends are in contact, and a fitting-up jig attached. For lap-welded slip joints, the spigot of the piece being laid shall be inserted into the bell of the previously installed pipe. No welding shall be done until the temperature of the pipes connected is uniform and approximately the same throughout their circumference. If necessary welding shall be done at night, or the pipes shall be protected from the rays of the sun, or other precautions adopted. Where welded pipeline joints are used, at intervals of not more than four hundred feet (400'), a slip joint shall be provided with four inch (4") longitudinal adjustment, as described in AWWA C206. After the joint is welded, the unprotected area of the pipe shall be cleaned and field lined and coated in accordance with AWWA C203 and/or C205 to the thickness specified for the pipe.

### **13.08.3 Mechanically Coupled Joints**

Mechanically coupled joints shall be used on steel pipe only as indicated on the approved plans. The thickness of middle rings shall be the same as the pipe on which the joint is installed. The grade of steel used shall meet the requirements for steel used for the pipe. Middle rings shall be fabricated to properly fit the outside diameter of the pipe on which the joint is installed. Middle and follower rings shall be cleaned and primed after fabrication. Pipe stops shall not be provided on middle rings of mechanically coupled joints adjacent to line valves. Joint bonding shall be required on mechanically coupled joints.

The ends of the pipe on which couplings are to be placed and the couplings themselves shall be clean and free from any dirt or foreign matter, especially those surfaces of the pipe and coupling which come in contact with the gaskets. Gaskets shall be kept clean with no foreign matter between them and the facing surfaces. Wrenches used in bolting couplings shall be of a type and size recommended by the coupling manufacturer. Coupling bolts shall be tightened to the manufacturer's specified torque. Coupling bolts shall be so tightened as to secure uniform annular space between the follower rings of the housing-clamps and the body of the pipe. All bolts shall be tightened to the same torque with all parts of the coupling square and symmetrical with the pipe. After installation, primed couplings shall be carefully touched up or reprimed if necessary.

Insulating couplings and/or flanges shall be installed in the steel pipeline to facilitate future cathodic protection at locations indicated on the drawings or as directed by the Engineer.

#### **13.08.4 Bell-and-Spigot Joints**

Bell-and-Spigot joints for steel water lines shall be allowed only with written permission from Aurora Water. Bell-and-Spigot joints shall be stab type joints consisting of a rubber gasket bell and spigot. Interior dimensions of the joint shall be the same as those of the pipe. Gasket materials shall conform to the requirements of AWWA C200. The joints shall be designed to remain water tight under all service conditions, including expansion, contraction, and earth settlement. The gasket shall not support the entire weight of the pipe. Spigot ends shall have a groove to retain the gasket. Pipe ends shall be self-centering without the aid of the gasket. A rust inhibitor protective coating, which is compatible with the material used for pipe lining, shall be applied to the interior surface of the bell and the exterior surface to the point where the spigot enters the bell.

### **13.09 Installation**

Pipe shall be installed in accordance with AWWA manual M11 and in accordance with any special requirements of the Engineer. Bench testing of any required butterfly valves must be witnessed (150 Psi for 10 minutes) by an Aurora Water Inspector. See Section 15.04 for further detail.

#### **13.09.1 Trench Width**

The maximum trench width shall be the outside diameter of the pipe plus three feet (3'). Whenever the allowable trench width is exceeded, the Engineer shall be notified. Any improved bedding required by the Engineer shall be at the expense of the Contractor. There shall be a minimum clearance between the pipe and the trench wall of eight inches (8").

#### **13.09.2 Bedding**

Pipe shall be bedded in accordance with the bedding class noted on the plans. Under no circumstance shall the bedding class be less than Class B alternate. Compaction shall be in accordance with these specifications.

### **13.10 Cathodic Protection**

See Section 20.00 for of these specifications for cathodic protection requirements.

## **SECTION 14.00 POLYVINYL CHLORIDE (PVC) WATER LINE**

- 14.01 General
- 14.02 Materials
- 14.03 Fittings and Specials
- 14.04 Diameter of Pipe
- 14.05 Storage of Pipe
- 14.06 Sunburned Pipe
- 14.07 Installation

## **SECTION 14.00 POLYVINYL CHLORIDE (PVC) WATER PIPE**

### **14.01 General**

PVC pipe shall comply with either AWWA C900 for pipe sizes six inches (6") through twelve inches (12") and C905 for pipe sizes sixteen inches (16") or above and shall be clearly marked on each section of pipe. All pipe shall be suitable for use as a pressure conduit.

PVC WATER MAIN SHALL BE REQUIRED FOR USE WHEN RESISTIVITY TESTS OF THE SURROUNDING SOIL ARE LESS THAN ONE THOUSAND (1,000) OHM-CENTIMETER.

### **14.02 Materials**

All PVC pipe used for water main within the City of Aurora shall be Pressure Class 305 and shall conform to the requirements of DR 14 for C900 four inches (4") to twelve inches (12") (pressure class 305) and DR 18 for C905 (pressure class 235) fourteen inches (14") and up. Furthermore, PVC pipe shall be furnished in cast-iron pipe equivalent outside diameters. The bell shall consist of an integral wall section with an elastomeric ring meeting the requirements of ASTM F477. The wall thickness in the bell section shall conform to the requirements of ASTM D-3139 with all measurements made according to ASTM D2122. Pipe shall also meet the National Sanitation Foundation Standard No. 61 and shall be furnished in twenty foot (20') laying lengths.

### **14.03 Fittings and Specials**

Fittings and specials shall be cast or ductile iron and conform to these specifications. All fittings shall be epoxy coated fittings, double wrapped with eight (8) mil polyethylene extended for one foot (1') and tightly taped on both sides of fitting. Anodes for fittings shall be applied only at the discretion of Aurora Water Corrosion Engineer.

### **14.04 Diameter of Pipe**

The diameter shown on the drawings shall mean the nominal inside diameter of the pipe.

### **14.05 Storage of Pipe**

All pipe ends shall be capped at the factory prior to being shipped. Pipe arriving onsite without the ends capped shall be rejected. Pipe shall be stored in a way that shall protect the pipe from damage due to exposure to sunlight.

### **14.06 Sunburned Pipe**

Pipe discolored to any extent shall be considered as having sunburn damage and shall be rejected and removed from the project.

### **14.07 Installation**

Pipe shall be installed according to AWWA Standard C900/A.1.1.3 and according to these specifications.

**All PVC water pipe shall be installed with an electronic marker system for locating purposes. Tracing wire is not allowed. Spigot shall not be inserted in the bell past the home line indicated on the spigot or the installation shall be rejected. Joint deflection on PVC pipe is not allowed without the approval of Aurora Water Engineering and shall not exceed manufacturer's recommendation.**

#### **14.07.1 Trench Width**

The maximum trench width shall be the outside diameter of the pipe plus three feet (3'). Whenever the allowable trench width is exceeded, the Engineer shall be notified. Any improved bedding required by the Engineer shall be at the expense of the Contractor. Minimum clearance between the pipe and the trench wall shall be eight inches (8").

#### **14.07.2 Bedding**

Class B Alternate bedding as described in these specifications shall be the minimum class of bedding used for PVC pipe. Compaction shall be according to these specifications.

#### **14.07.3 Electronic Marker System**

PVC water pipe shall be installed with electronic markers at a spacing of one marker for every sixty (60) lineal feet of pipe, and at every tee, bend or deflection in the pipe. These markers shall be blue in color and as manufactured by 3M Scotchmark or approved equal. Mid-range markers shall be used for waterlines less than six feet (6') in depth, and full range markers shall be used for any portions of waterlines greater than six feet (6') in depth.

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## **SECTION 15.00 WATERLINE VALVES**

- 15.01 General
- 15.02 Installation
- 15.03 Gate Valves
- 15.04 Butterfly Valves
- 15.05 Pressure Reducing and Regulating Valves
- 15.06 Check Valves
- 15.07 Air and Vacuum Valves
- 15.08 Blow-off Valves
- 15.09 Valve Boxes
- 15.10 Valve Vaults
- 15.11 Reference Markers

## **SECTION 15.00 WATERLINE VALVES**

### **15.01 General**

All valves shall be manufactured according to AWWA Standard C500 and shall open by turning clockwise (RIGHT). Valve ends shall be mechanical joint or flanged ends and shall be equipped with two inch (2") square operating nuts. Valves and flanges shall be Class 200 unless otherwise specified. All valve operating nuts shall extend to within four feet (4') of finished grade. No valves less than four inches (4") in diameter shall be installed on the public main. Valve boxes shall be located no less than three feet (3') from electrical, cable, telephone or gas lines and no less than two feet (2') from cross pans, valley or gutter pans, or curb and gutter.

### **15.02 Installation**

Valves in water mains shall be installed, where possible, at a point on the main which would be intersected by an extension of a property line. Valves shall be installed so the operator is in a vertical position and can be operated from above ground. Valves shall be adjusted to seat properly.

### **15.03 Gate Valves**

Gate valves shall be used on all water lines twelve inch (12") waterlines or smaller. Sixteen inch (16") gate valves may be used only with the approval of Aurora Water Engineering. No ten inch (10") gate valves shall be installed on the public main. All gate valves shall be manufactured according to AWWA Standard C500, (Resilient Seat-AWWA C-509) and shall be either resilient seat or double-disc, parallel seat, iron body, bronze mounted, non-rising stem, equipped with "O"-ring stem seals and shall open by turning clockwise (RIGHT). All interior surfaces on resilient seat valves shall be epoxy coated according to AWWA C-550. Valve ends on resilient seat valves shall be mechanical joint. Valve operators shall be covered with a buffalo type valve box five and one quarter inches (5 ¼") in diameter. The word "WATER" shall be cast in the valve box cover.

### **15.04 Butterfly Valves**

Butterfly valves can be used in sizes sixteen inch (16") and larger and shall conform to Specification AWWA C504. All interior surfaces on butterfly valves shall be epoxy coated according to AWWA C-550. Butterfly valves shall be furnished with mechanical or flanged end connections and shall be suitable for buried service installation. Butterfly valves shall be installed per these specifications. Butterfly valves shall be adjusted to ensure they shall seat completely and shall not leak. All valves shall open clockwise (RIGHT). All butterfly valves shall have seating rubber in the valve body and not in the metal disc or be epoxy-coated at the factory.

Butterfly valves must be independently bench tested and certified to one hundred fifty (150) psi prior to installation. Both side of the valve are required to be individually tested for ten (10) minutes. Any observed leaks shall constitute a failed test and the valve shall be returned to the manufacturer. Butterfly valves installed without first undergoing testing and certification are subject to removal at the Contractor's expense. Aurora Water



reserves the right to witness testing upon notification of Contractor. The Contractor should allow for sufficient time to test valves prior to requiring the approved valve at the work site.

### **15.05 Pressure Reducing and Regulating Valves**

Pressure reducing and regulating valves shall be of a type capable of maintaining pre-adjusted downstream pressures with varying rates of flow and upstream pressure without causing water hammer. Pressure reducing and regulating valves shall be installed in specially designed concrete valve vaults. Pressure reducing valves shall only be installed with the specific approval of location by Aurora Water Engineering. Pressure reducing and regulating valves shall be of the flanged, globe body, external pilot operated, and diaphragm type with the following requirements:

- Have flanged cast iron bodies of two hundred (200) psi Class and be epoxy-coated both internally and externally. All flanges shall use stainless steel bolts and be externally epoxy-coated.
- Be designed and constructed so as to facilitate repairs and internal dismantling without removal of valve from pipe line.
- Be constructed of new, first quality materials and components throughout including inlet and outlet gauge test ports.
- Be constructed so as to provide easy access to the pilot(s) and to allow pilot(s) removal while main valve is under pressure.
- Be furnished with all necessary pilot(s), blocking valves, needle valve(s), strainer(s), sight glass indicators and control piping.
- A gate valve or butterfly valve shall be installed on each side of a pressure regulating valve outside the vault. Mechanical couplings are required at the valve for butterfly valve installations.
- Check valves shall be installed in precast concrete manholes or vaults and fitted with air vents open to the atmosphere according to these specifications.

### **15.06 Check Valves**

Check valves shall be installed in all cases to preserve the integrity of the water system. The valve shall seal tightly when the discharge pressure is greater than the inlet pressure and permit flow when the discharge pressure is less than the inlet pressure. Check valves shall be hydraulically operated by line pressure, and shall be of the diaphragm globe type. All necessary repairs other than the replacement of the valve body shall be possible without removing the valve from the line.

Check valves shall be installed in precast concrete manholes or vaults and fitted with air vents open to the atmosphere according to these specifications. Gate valves shall be located on either side of the manhole or vault outside the vault.

### **15.07 Air and Vacuum Valves**

Combination air and vacuum release valves shall be installed at each high point in all water mains of sixteen inch (16") diameter and larger. Air and vacuum release assemblies require no less than six feet (6') of vertical clearance from bottom of vault lid

to the top of the pipe. Air and vacuum release valves shall be installed in precast concrete manholes or vaults open to the atmosphere with approved frost lid ring and cover assemblies in accordance to these specifications. See Appendix B, Approved Materials List, for approved valves.

### **15.08 Blow off Valves**

Blow-off hydrant per these specifications is required at the end of mains extended into cul-de-sacs. Temporary blow-offs shall be installed in those portions of the water mains, which cannot be chlorinated, flushed or tested by other means. Larger water mains (sixteen inch (16") or larger) may require larger diameter blow-off assemblies (six inch (6") minimum) and shall be installed according to these specifications with right-hand open valves.

Blow-off assemblies consist of all valves, pipe and material necessary to install the blow-off valve complete in place.

### **15.09 Valve Boxes**

All gate valves shall be provided with a five and one quarter inch (5¼") cast iron screw type, Buffalo style valve box. The valve box shall be of a design which shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut of the valve, with the box cover flush with the surface of the pavement.

### **15.10 Valve Vaults**

All valve vaults shall be designed to adequately house the valves and fittings therein contained as well as to withstand all external loadings imposed by earth, thrust, and AASHTO HS-20 loading. Vaults shall be furnished with removable roof slabs or manholes of sufficient size to allow removal of all valves and fittings, shall be constructed in such a manner as to allow operation of all valves from above ground, with a four and one half foot (4½') valve key and shall be fitted with air vents open to the atmosphere. Vaults shall be built in accordance with the approved drawings and these specifications. Air/vac Vaults shall have approved frost lid ring and cover assemblies.

### **15.11 Reference Markers**

Whenever a valve is located outside of a traveled street or walkway, a reference marker shall be installed three feet (3') from the valve box. The reference marker shall be a three inch (3") galvanized pipe filled with dirt and capped with concrete. The pipe shall be five feet (5') long, set in at least an eight inch (8") diameter hole a depth of two feet (2') and filled with concrete. The pipe shall be painted fire hydrant yellow. Reference information shall be painted on the reference marker per these specifications. Anode and test site markers shall be marked with a marking post per these specifications.

Valve Boxes not located within a pavement section shall be provided with an eighteen inch (18") square by four inch (4") deep concrete collar.

## **SECTION 16.00 FIRE HYDRANTS**

- 16.01 General
- 16.02 Hydrant Details
- 16.03 Installation
- 16.04 Testing
- 16.05 Fire Hydrant Location
- 16.06 Fire Hydrant Spacing
- 16.07 Relocations

## **SECTION 16.00 FIRE HYDRANTS**

### **16.01 General**

All fire hydrants shall conform to AWWA Standard C502. Dry barrel hydrants with drain valves are the only type of hydrants allowed in the City of Aurora. All fire hydrants shall have a five and one half foot (5½') bury depth. Fire hydrants with up to seven feet (7') bury depth shall be allowed by utilizing barrel extensions with a five and one half foot (5½') barrel only. In no case shall the bury depth exceed seven feet (7'). Vertical bends with gravity thrust blocks with a maximum deflection of forty-five degrees (45°) degrees shall be used to adjust the bury depth to five and one half feet (5½') if the seven foot (7') maximum bury depth cannot be achieved. A fire hydrant shall consist of all valves, piping and materials necessary to install the hydrant in conformance with these specifications, see Appendix B; Approved Materials List, for approved products and manufacturers.

### **16.02 Hydrant Details**

#### **16.02.1 Hydrant Nozzle Openings and Operating Nut**

Hydrants shall have two (2) hose nozzles, each measuring two and one half inches (2½") on the inside diameter and each having National Standard threads. All hydrants shall have one pumper nozzle measuring four and one half inches (4½") on the inside diameter, having Denver Standard threads, six (6) threads per inch, stainless steel fasteners on all stem components, and shall have bronze to bronze main valve seats. The main hydrant valve opening shall be five and one quarter inches (5¼"). The operating nut and nozzle caps shall be pentagon shaped and measure one and one half inch (1½") from point to the opposite flat.

#### **16.02.2 Color**

All hydrants shall be painted fire hydrant safety yellow according to AWWA C502. Fire hydrants serving reuse or reclaimed water shall be purple in color. Fire hydrants serving raw water shall be olive green in color.

#### **16.02.3 Coatings**

All hydrants shall have epoxy coatings according to these specifications unless otherwise approved by Aurora Water Engineering. Epoxy coating shall extend to the hydrant's lower valve plate and include the foot valve housing.

### **16.03 Installation**

#### **16.03.1 Hydrant Drainage**

A minimum of one third (1/3) cubic yard of three quarters inch (¾") to one inch (1") clean river rock shall be installed around the foot of the hydrant to facilitate proper drainage of the hydrant. The rock shall be covered with a sheet of eight (8) mil polyethylene.

#### **16.03.2 Hydrant Orientation**

The hydrant shall be plumbed and installed so the pumper nozzle faces the street or fire lane as noted on the approved project drawings. The City of Aurora Life Safety Division shall determine the direction of proposed fire hydrant installations.

### **16.03.3 Traffic Safety Flange**

The traffic safety flange must be not less than two inches (2") nor more than six inches (6") above the finish grade. Mounding of landscape material around the hydrant is not allowed. Furthermore, no more than one extension up to a maximum of eighteen inches (18") in height shall be allowed on a hydrant at the time of acceptance.

### **16.03.4 Grade Staking**

All fire hydrants must be staked to finish grades.

### **16.03.5 Hydrant Laterals**

The piping from the main to the hydrant shall be no less than six inches (6") in diameter and all piping shall be according to these specifications. All piping shall be DIP according to these specifications unless otherwise approved by Aurora Water Engineering. The fire hydrant shall be harness Mega-lugged to the main according to these specifications and shall have a thrust block. Fire hydrants require a concrete support beneath the hydrant base per Standard Detail #208. Ninety degree (90°) bends are not allowed on fire hydrant laterals.

Each fire hydrant shall have a six inch (6") gate valve on the lateral pipe. The valve shall be designed and installed in accordance these specifications. The valve shall be located next to the water main supplying the fire hydrant. All water system valves and fire hydrants shall open to the right.

If resistivity is less than or equal to one thousand (1,000) ohm-centimeters, PVC water main shall be used for fire hydrant laterals.

## **16.04 Testing**

All fire hydrants shall be tested and disinfected according to these specifications. Any hydrant failing to drain properly shall be reinstalled to permit proper drainage.

## **16.05 Fire Hydrant Location**

In general, all fire hydrants shall be unobstructed on the street side and shall be located not less than three feet (3'), six inches (6") nor more than eight feet (8') from the back of curb to the center line of the hydrant. Minimum length of fire hydrant laterals is five feet (5'). Minimum clearance on all sides shall be five feet (5'). See the following criteria for specific location requirements. In no case shall fire hydrants be located within sidewalks, bike paths or handicap ramps.

### **16.05.1 Attached Ten (10) Foot Wide Bike Path**

Fire hydrants shall be located one foot (1') from the edge of an attached ten foot (10') wide bike path (eleven feet (11') from the back of curb). If the fire hydrant is located further than two feet (2') six inches (6") from the edge of the bike path (thirteen feet (13'), six inches (6") from the back of curb), the hydrant shall be relocated to one foot (1') from the edge of the bike path.

#### **16.05.2 Attached Eight (8) Foot Wide Bike Path**

Fire hydrants shall be located one foot from the edge of an attached eight (8) foot wide bike path (nine feet (9') from the back of curb). If the fire hydrant is located further than two feet (2'), six inches (6") from the edge of the bike path (ten feet (10'), six inches (6") from the back of the curb), the hydrant shall be relocated to one foot (1') from the edge of the bike path.

#### **16.05.3 Attached Five (5) Foot Wide Sidewalk**

Fire hydrants shall be located one foot (1') from the edge of the sidewalk (six feet (6') from the back of curb). If the fire hydrant is located further than three feet (3') from the edge of the sidewalk (eight feet (8') from the back of curb), the hydrant shall be relocated to one foot (1') from the edge of the sidewalk.

#### **16.05.4 Detached Sidewalk or Bike Path**

Fire hydrants shall be located no less than three feet (3'), six inches (6") from the back of the curb to the centerline of the hydrant (eighteen inches (18") from the edge of walk) when the sidewalk or bike path is detached from the curb by a five foot (5') wide, or larger, landscape buffer. No part of the hydrant is allowed to extend over the walk surface. If the fire hydrant is located closer than three feet (3'), six inches (6") from back of curb to the centerline of the hydrant, or any part of the hydrant extends over the walk surface, the hydrant shall be relocated to one foot (1') from the outside edge of the sidewalk.

#### **16.05.5 Landscaped Median Islands**

Fire hydrants located within five foot (5') wide landscaped median islands shall be located two feet (2'), six inches (6") from the back of curb to the centerline of the hydrant. In addition, the hydrant shall be located three feet (3'), six inches (6") from the back of the curb at the nose of the median. If the hydrant is located less than two feet (2') from the back of the closest, adjacent curb to the centerline of the hydrant, the hydrant shall be relocated to no less than two feet (2'), six inches (6") from the back of the curb to the centerline of the hydrant. Bollards may be required for these installations as necessary. Aurora Water Engineering shall determine bollard locations.

#### **16.05.6 Valley Pans or V-Section Streets**

Fire hydrants located on streets without vertical curb and gutter, or with gutter pans or asphalt edges, shall be located no less than three feet (3'), six inches (6") and no further than eight feet (8') from the edge of concrete or asphalt to the centerline of the hydrant. If the fire hydrant is located closer than three feet (3'), six inches (6") or further than eight feet (8') from the edge of the concrete or asphalt to the centerline of the hydrant, the hydrant shall be relocated to three feet (3'), six inches (6") from the edge of the concrete or asphalt.

Bollards are allowed if in the opinion of the Engineer the hydrant is subject to damage by the travelling public, and require approval by the Engineer. All bollards shall be installed according to these specifications.

### **16.06 Fire Hydrant Spacing**

Fire hydrant spacing shall not exceed the distance recommended in the International Fire Code as currently adopted by the City of Aurora.

### **16.07 Relocations**

Fire hydrant relocations are allowed as approved by Aurora Water Engineering. Hydrants over five (5) years old must be replaced. The fire hydrant lateral shall be required to undergo testing per these specifications. Aurora Water shall not be responsible for any testing failure due to the Contractor using or testing against existing valves or hydrants.

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## **SECTION 17.00 WATER SERVICE LINES**

- 17.01 General
- 17.02 Location and Alignment of Service
- 17.03 Materials
- 17.04 Crossing of Sidewalk or Curb
- 17.05 Service Stub-Ins
- 17.06 Tapping the Main
- 17.07 Service Line Installations
- 17.08 Meter Pit Installations
- 17.09 Multi-family Meter Installations
- 17.10 Re-use and Relocation of Existing Meter Pits
- 17.11 Discontinuation of Water Service

## **SECTION 17.00 WATER SERVICE LINES**

### **17.01 General**

All water service line construction connecting to the City of Aurora Water Distribution System shall be constructed according to these specifications. These specifications shall cover all new water service line construction and repairs to existing lines from the water main to the building plumbing. Certificates of Occupancy (C.O.'s) shall not be issued prior to the meter set.

No meter will be furnished or installed until the service installation is in conformance to these specifications.

**All PVC water pipe shall be installed with an electronic marker system for locating purposes. Tracing wire is not allowed. Spigot shall not be inserted in the bell past the home line indicated on the spigot or the installation shall be rejected. Joint deflection on PVC pipe is not allowed without the approval of Aurora Water Engineering and shall not exceed manufacturer's recommendation.**

### **17.02 Location and Alignment of Service**

Water service lines shall be constructed on the shortest and straightest route possible. At no time shall the service line be any closer than five feet (5') to the side property line, and no service line may be constructed through or in front of any adjoining property. The service line shall be located ten feet (10') from the sewer service the entire distance from the point of connection at the water and sewer main to the building.

Water service lines shall not be permitted under the driveway without written permission of the Engineer. A PVC sleeve is required if a location under the driveway is approved.

### **17.03 Materials**

#### **17.03.1 Pipe**

All piping for two inch (2") and smaller service lines shall be installed clean and shall be copper tubing type K, either soft temper or hard drawn. Three inch (3") or larger water service lines shall be Class 52 ductile iron pipe.

#### **17.03.2 Tapping Saddles**

Tapping saddles are required for **all** service taps on PVC and Asbestos Cement (AC) water main. Furthermore, saddles shall be required on all taps one and one half inch (1½") or greater on eight inch (8") or smaller ductile iron pipe.

Tapping saddles shall be double-strap comprised of all bronze components including nuts, bolts, straps and body. See Appendix B, Approved Materials List, for approved manufacturers.

#### **17.03.3 Fittings**

All fittings shall be certified "No-Lead" per AWWA Standard C-800.

#### **17.04 Crossing of Sidewalk or Curb (Existing or Proposed)**

In no instance shall a service trench extend beneath an existing sidewalk or curb. The pipe must be bored, or jacked through the earth, under the curb or sidewalk. The trench shall be backfilled according to these specifications.

#### **17.05 Service Stub-Ins**

Service stub-ins shall extend at least to the curb stop or the meter pit. The meter yoke shall be installed as shown on the standard details.

#### **17.06 Tapping the Main**

The Contractor shall make two inch (2") and smaller taps on the pressured main after testing, and initial acceptance of the main by Aurora Water. The Contractor shall supply the tapping saddle, if necessary. The Inspector will inspect the tap, corporation stop and the service line from the main to the meter, for all service taps, prior to the Contractor backfilling the service line trench. If the tap is backfilled prior to inspection, the Contractor shall be required to expose the tap and service line for inspection.

Aurora Water will make water taps for three inch (3") and larger meter installations on the main per these specifications. These taps shall be no less than four inches (4") in size, and will be reduced to three inch (3") diameter prior to the meter location.

A thirty-six inch (36") minimum separation is required between service taps on a main line or from the nearest joint.

**No service taps shall be permitted on mains larger than twelve inches (12") diameter without Aurora Water authorization.**

The remainder of the service line from the meter pit to the residence is then installed according to the standard details. An Inspector must make a visual inspection of the line before backfilling this portion of the line. Should the line be backfilled before an inspection, the Contractor shall expose the line for inspection. The request for inspection must be made one (1) business day in advance.

#### **17.07 Service Line Installations**

All service line installation work shall conform to the standard details. Aurora Water will make the physical taps for all three inch (3") and larger meters on the water main after the main has passed inspection and is initially accepted. Aurora Water will furnish and install the water meter once the applicable connection fees have been paid. The Applicant for the water service connection shall, at his sole expense, provide and install the trench, tap for two inch (2") and smaller service lines, insulator, service line pipe, tapping saddle and meter yoke where required, check valve, meter pit or vault, meter pit or vault cover, and curb stops.

All water service lines are required to be dielectrically isolated from the mains.

**Electrical ground to water service lines and fire service laterals is strictly prohibited.**

All service lines shall be of uniform size from the service line tap to the building structure or structures except three inch (3") meters which require a four inch (4") service lines, gate valve at the point of connection, or as otherwise approved by Aurora Water. Aurora Water reserves the right to require a larger service connection to any building, structure, or development if the water requirements, when calculated by the fixture unit method as specified in the current adopted International Plumbing Code, cause the service line velocity to exceed ten feet (10') per second.

All bends in copper service lines shall have a minimum radius of twelve inches (12"). No lead soldered joints are allowed on any section of the water service lateral. Furthermore, field soldered joints are not allowed on the section of the water service lateral between the main and the meter pit.

Service lines larger than two inches (2") in diameter shall be required to undergo testing per these specifications from the main to the building water connection.

Wherever a backflow prevention assembly is required by Aurora Water Engineering to prevent contamination of the public water supply through a specific service connection, such backflow prevention assembly of a type and design approved by Aurora Water shall be furnished and installed by the Owner/Developer. All fire lines, commercial, multi-family and master metered single family residential water service lines require backflow assemblies which shall include, but not be limited to, clubhouses, pools, churches, etc. Backflow prevention assemblies shall be installed per these specifications.

### **17.08 Meter Pit Installations**

Meter pits shall be located in landscaped areas, within the public right-of-way or in a utility easement or they shall be re-located. In addition, meter pits shall be located such that a minimum of two feet (2') of distance from the edge of the lid to the back of the nearest curb, sidewalk or valley pan according to the applicable standard detail. Meter pits shall not be installed in or under driveways, sidewalks, streets or parking areas. Meter pits shall be located away from hazards, i.e., steam vents, electrical equipment. Remote reading meters, where the meter is installed within the building foundation, are not allowed. No shrubs or trees are allowed within the pocket utility easement or within 5 feet of a meter pit.

All materials shall be of new quality and free of defects.

Meter pits shall be staked in the field if curb and gutter are not installed. Lowering of meter pits shall not exceed six inches (6") without adjusting the accompanying water service lateral. The meter pit shall be at final grade at the time the meter is to be installed. Any adjustment in the grade of the meter pit, meter yoke or brace shall be by and at the expense of the owner. Final grades may be evidenced by the presence of a curb and gutter. If curb and gutter is not present, the owner shall assume responsibility for

adjusting meter pits and service laterals as necessary to conform with these specifications.

Meter pits shall be vertically plumb.

Meter pits shall be constructed so the rings and hoods do not have spaces between them. The pits shall be free of trash and shall have a minimum depth of four feet (4') from finished grades. Hoods shall be raised with riser rings only and have a two inch (2") hole predrilled in the center of the hood lid for three quarter inch ( $\frac{3}{4}$ ") and one inch (1") meters.

Backfill around a meter pit and in the trench shall be according to these Specifications.

### **17.09 Multi-Family Meter Installations**

Each building containing vertically stacked units in a multi-family development shall require a single meter for each building. Individual units separated only by a common vertical wall must have an individual service line and meter for each unit. Single family attached developments may be allowed one (1) meter per group of units at the sole discretion of Aurora Water Engineering.

### **17.10 Reuse and Relocation of Existing Meter Pits**

Existing meter pits must conform to all applicable standards for any site re-development. The maximum allowable distance a meter pit may be relocated is ten feet (10'). Otherwise, the water main shall be re-tapped and the existing service connection shall be disconnected at the main.

### **17.11 Discontinuation of Water Service**

Whenever a building is torn down or removed, the service line shall be uncovered at the water main and the service corporation closed. A section of the service line one foot (1') in length shall be removed at the corporation to disconnect the line physically and the threads shall be sawed off at the outlet. An Inspector will inspect the disconnection before backfilling the hole. Backfilling shall be according to these specifications. The gate valve isolating the service from the public main shall be required to be removed and the tee blind-flanged for service line abandonments of three inch (3") and larger services.

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**SECTION 18.00 AUTOMATIC FIRE SUPPRESSION SYSTEM**  
**WATERLINES**

18.01 Ownership

18.02 Installation

18.03 Testing

18.04 Emergency Repair of Underground Fire Service Mains

## **SECTION 18.00 AUTOMATIC FIRE SUPPRESSION WATERLINE INSTALLATION**

### **18.01 Ownership**

Automatic fire suppression lines shall be defined as water lines used solely for serving the interior of a building with either automatic and/or manual fire extinguishing systems. The private fire suppression line shall start on the system side of the valve connecting it to the City water supply and end at the flange in the riser room.

**Tapping these lines for fire hydrants, domestic water and/or any other purpose shall not be permitted.**

These lines shall be privately owned and maintained, and in no manner shall be the responsibility of the City of Aurora. Water supply for automatic fire suppression systems in single family (detached) residences (SFR) must comply with Chapter 29 of the currently adopted International Residential Code (IRC) or IRC referenced National Fire Protection Association (NFPA) 13D. Fire service lines may be tapped from the domestic service lines where the capacity to supply the two (2) hydraulically most demanding sprinklers at the minimum required volume and pressure, and maintain that supply for the minimum time periods. The potable water supply to automatic sprinkler and standpipe systems shall be protected against backflow by a double check-valve assembly or a reduced principle backflow preventer. All other construction shall require a separate fire suppression line from the domestic service.

### **18.02 Installation**

The installation of fire mains shall comply with the currently adopted National Fire Protection Association (NFPA) standard referenced by currently adopted International Fire Code.

- IRC, Chapter 29, International Residential Code
- NFPA 13/13-R/13D, Standard for Installation of Sprinkler Systems.
- NFPA 24, Standard for Installation of Private Fire Service Mains.

The fire riser room shall be located adjacent to an exterior wall. The underground fire service main can run under the foundation of the exterior wall, but shall not run under buildings. (NFPA 10.6.1).

All fire service lines must be installed, in their entirety, by an individual or company registered as "Fire Suppression System Contractor - Underground" through the Colorado Department of Public Safety, Division of Fire Prevention and Control. In addition, approved civil plans from Aurora Water are required for all new installations of fire service line connections. The Contractor must present their current State registration and approved civil plans to Aurora Water before permits will be issued.

Fire service lines shall be installed per these specifications. All fire service lines shall be Ductile Iron for three inch (3") and larger or type K copper for two inch (2") and smaller



from the main line to backflow assembly. Ductile iron fire service lines shall be completely restrained for the entire length. PVC may be used for fire service lines three inch (3") and larger, when soil resistivity tests indicates resistivity less than one thousand (1,000) ohm-centimeters.

Two inch (2") and smaller fire service lines shall have a tee and four inch (4") gate valve with a two inch (2") or smaller threaded plug, copper service threaded union, and service insulator per these specifications. Three inch (3") or larger fire lines shall have a tee, four inch (4") gate valve, and four inch (4") inch by three inch (3") reducer per these specifications.

All fire service lines shall be isolated from the City main by a gate valve at the point of connection. Under no circumstances shall the isolation valve be less than four inches (4") in diameter. Valve boxes for fire suppression lines must have locking lids. This valve is considered public and shall be owned and operated by Aurora Water personnel only. On existing water mains the City of Aurora will provide the tee, valve, valve box and perform the four inch (4") wet tap for all fire service lines after the applicable wet tap fees have been paid to the Tap Applications counter at Aurora Municipal Center, 15151 East Alameda Parkway, Suite 2400, Aurora, Colorado 80012. Construction plans must be reviewed and approved by the Aurora Water prior to obtaining a permit.

**Electrical grounding to fire suppression service laterals is strictly prohibited.**

### **18.03 Testing**

Fire service lines shall undergo chlorine, pressure and bacteria testing per these specifications with the exception of the hydrostatic pressure testing. This test shall be performed at two hundred (200) psi  $\pm$  five (5) psi and shall be maintained for two (2) hours. Any testing of a private fire service lateral shall be performed against a new isolation valve at the City system. Repair of an existing line requires the Contractor to provide a bulkhead or a new valve at the tie in.

Fire suppression service laterals are required to be inspected by a State Certified Inspector when the lateral is serving a health care facility. The installation contractor is required to insure this requirement is satisfied prior to placing the system in service.

Once the fire line has passed initial testing, flow tests shall be conducted before connection is made to the sprinkler system piping. The hydrostatic test shall be witnessed by a Building Division-Fire Line Safety inspector. The Contractor will have the NFPA 24 Standard and Contractor's Material and Test Certificate for Underground (NFPA 24, Figure 10.10.1) form available to the inspector prior to the flow test. The Contractor is required to call the Building Division no less than two (2) business days in advance to schedule a flow test. All costs and equipment associated with the testing shall be the owner's responsibility.

Prior to the connection of the overhead fire sprinkler system, the underground portion must be flushed per NFPA 24. The flushing operation shall continue for a sufficient time to ensure thorough cleaning. The minimum rate of flow shall be not less than one of the following:

- (1) The hydraulically calculated water demand rate of the system including any hose requirements.
- (2) The flow necessary to provide a velocity of ten feet (10') (see table below).

Pipe Size	Flow Rate
Inches	gpm
4	390
6	880
8	1560
10	2440
12	3520

- (3) The maximum flow rate available to the system under fire conditions.

These tests shall be subject to inspection by an N.F.P.A. certified inspector from the C.O.A. Building Division. The Contractor is required to call the Building Division at 303-739-7420 no less than forty-eight (48) hours in advance to schedule a flow test. All costs and equipment associated with the testing shall be the owner's responsibility.

#### **18.04 Emergency Repairs of Underground Fire Service Mains**

Private Extension Permits are required for the repair of any private underground fire service main. Emergency repairs do not require an approved plan, however still require permitting. Permits for emergency repairs of fire service mains are issued only to individuals or companies who are registered as "Fire Suppression System Contractor - Underground" through the Colorado Department of Public Safety, Division of Fire Prevention and Control.

Please contact:

Operations Service Center (7:30AM-3:30PM) to report fire service main breaks, leaks, and issues.

Flow Control Center (3:30PM-7:30AM) to report issues outside of normal operating hours.

## **SECTION 19.00 BACKFLOW PREVENTION ASSEMBLIES**

- 19.01 General
- 19.02 Irrigation Systems
- 19.03 Fire Suppression Systems
- 19.04 Installation
- 19.05 Testing and Reporting

## **SECTION 19.00 BACKFLOW PREVENTION ASSEMBLYS**

### **19.01 General**

#### **19.01.1 Backflow Prevention Requirements**

Fire service lines without chemical feed systems require at least a double check backflow assembly. All other fire lines, commercial, multi-family and master metered single family residential water service lines require a reduced pressure backflow assembly as required by Aurora Water. Backflow prevention shall be designed and installed per Colorado Primary Drinking Water Regulation 11.39.

Building plans must be submitted, approved and permitted through the City of Aurora Building Division and will be reviewed by the Aurora Water Department. Building Plans must show at a minimum:

- Water service type, size and location.
- Backflow prevention assembly manufacturer, size, type and location.
- Adequate drainage as needed if installed inside.
- Thermal expansion tank as required by code.
- Fire sprinkling system(s) service line, size and type of backflow prevention assembly, if applicable.
- Irrigation system(s) service line, size and type of backflow prevention assembly.

If it becomes necessary to install a booster pump on the water service line to any consumer's premises due to low pressure or special operating conditions, such service lines shall be protected by the installation of an approved air-gap separation or an approved reduced pressure principle assembly.

#### **19.01.2 Ownership**

All costs for design, installation, maintenance, repair, and testing are to be borne by the owner or the party billed for water service.

#### **19.01.3 Existing Installations**

Backflow preventers currently installed, which are not approved shall be replaced with an approved backflow prevention assembly at the time: they fail an operational test; the assembly shall be replaced; or if the assembly is determined to be non-testable or no longer approved for the degree of hazard.

No grandfather clauses exist. All laws and regulations apply regardless of the age of the facility.

#### **19.01.4 Approved Backflow Prevention Assemblies**

Any backflow prevention assembly required herein shall be of a model and size approved by Aurora Water Engineering. The term "Approved Backflow Prevention Assembly" shall mean an assembly manufactured in full conformance with the standards established by the latest version of the Colorado Cross-Connection Control Manual, the EPA Cross Connection Control Manual and 10<sup>th</sup> Edition of the USC Foundation Cross Connection

Control and Hydraulic Research Manual and/or by the Aurora Water Engineering. A single check valve is not considered an approved backflow prevention assembly.

### **19.01.5 Residential Services**

Backflow prevention in Single Family Detached and Single Family Attached buildings as defined by CDPHE regulation for water service must be accomplished with an assembly approved by the American Society of Sanitary and Mechanical Engineers and designated by Aurora Water Engineering.

## **19.02 Irrigation Systems**

### **19.02.1 Air-Gaps and Reduced Pressure Zone Assemblies**

Irrigation and lawn sprinkling systems connected to an irrigation or commercial meter, as classified by Aurora Water, shall be separated from the public potable water system by an approved air-gap separation or an approved reduced pressure zone assembly.

### **19.02.2 Pressure Vacuum Breakers**

All residential irrigation and lawn sprinkling systems must at minimum provide a pressure vacuum breaker. In residential irrigation and lawn sprinkling systems not incorporating the use of an injection system or booster pump(s), a pressure vacuum breaker assembly may be used. Irrigation and lawn sprinkling systems having quick-coupling valves or other similar type heads permitting pressure to be retained in the system shall have a pressure vacuum breaker assembly installed on the system. Irrigation and lawn sprinkling systems using the subsurface drip method shall also have a pressure vacuum breaker assembly installed on the system.

## **19.03 Fire Suppression Systems**

### **19.03.1 Requirements**

All fire lines supporting a fire sprinkler system shall require an approved reduced pressure backflow prevention assembly or an approved double check backflow prevention assembly as required by the Aurora Water Engineering. Installation of a backflow prevention assembly can reduce the required operating pressure of the overall fire sprinkler system flow requirements. An evaluation of this potential effect must be evaluated by a qualified sprinkler contractor and submitted to a City of Aurora Life Safety representative within the Building Code Division 303-739-7420 for review and approval prior to installation.

Backflow Assemblies used on fire lines shall be listed by the National Fire Protection Association and/or UL Approved.

All glycol (ethylene or propylene), or antifreeze systems shall have an approved Reduced Pressure Zone assembly for containment upstream of the point of use.

Dry fire systems shall have an approved Double Check Valve installed upstream of the air pressure valve.

Single family residences with a combined domestic water and fire sprinkler system shall have a double check valve when no chemicals are used.

## **19.04 Installation**

### **19.04.1 Location and Design**

Approved backflow prevention assemblies are to be installed in an accessible location to facilitate maintenance, testing and repair. Building plans must show the location of the backflow prevention assembly. Critical facilities may require redundant systems.

Backflow prevention assemblies shall be installed downstream of the water meter before any other tee or branch. In no case shall it be permissible to have any connections or tees between the meter and service line backflow prevention assembly.

Backflow prevention valves shall not be used as the inlet or outlet valve of the water meter. Test cocks shall not be used as supply connections.

Approved backflow prevention assemblies shall be installed without any bypass, unless the bypass line is also protected by an approved backflow prevention assembly providing an equivalent degree of protection.

All backflow Assemblies shall be installed in the horizontal position. Vertical installations shall be acceptable when approved by University of Southern California Foundation for Cross Connection Control and Hydraulic Research and/or American Society of Sanitary Engineering Specifications. Variances may be granted by review.

Proper drainage should be provided for the relief valve and may be piped away from the location provided it is readily visible from above grade and provided the relief valve is separated from the drain line by a minimum of double the diameter of the supply line. Freezing is a major problem in this area. Precautions shall be taken to protect above ground outdoor installations.

All assemblies must be on the approved list from one of the following organizations:

- American Society of Sanitary Engineering (ASSE), 901 Canterbury, Suite A, Westlake, OH 44145
- USC Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, KAP-200 University Park MC-2531, Los Angeles, CA 90089-2531

### **19.04.2 Basement Installations**

Basement installations are allowed providing the following conditions are met:

- Installation of a drain large enough to allow the maximum flow of discharged under twice the normal static water pressure for the assembly, and the installation of a high water alarm system. Electrical systems and/or components shall not be

installed in the same general area.

- The relief valve opening shall never have a water level under the assembly reach within a vertical distance of twelve inches (12") of the relief valve discharge port. The relief valve discharge port shall be directed down.
- The relief valve discharge port on a reduced pressure principle assembly shall not be connected to any sump or sanitary sewer.
- Only factory supplied funnels shall be used to remove the periodic discharge from the assembly and the piping system must have an approved air-gap at the termination of the run.

#### **19.04.3 Pressure Vacuum Breakers**

Pressure vacuum breakers shall be used only where the assembly is never subjected to back pressure and shall be installed a minimum of twelve inches (12") above the highest piping or outlet downstream of the assembly in a manner to preclude back pressure.

#### **19.04.4 Atmospheric Vacuum Breakers**

Atmospheric vacuum breakers shall be used only where the assembly is installed as an isolation assembly and is never subject to more than twelve (12) hours continuous backpressure. Atmospheric Vacuum Breakers shall be installed with the air inlet in a level position and a minimum of six inches (6") above the highest piping or outlet it is protecting.

#### **19.04.5 Double Check Valve Assemblies**

Double check valve assemblies may not be installed in below grade vaults, but shall rather be located in above ground vaults that have been designed to prevent the assembly from freezing. Double check valve assemblies are only allowed to be installed on dry fire systems and shall not be utilized for chemical feed fire suppression systems unless the chemical feed itself is protected by a Reduced Pressure Backflow device. Furthermore, adequate clearance shall be provided for testing, drainage, flushing and repairs.

#### **19.04.6 Reduced Pressure Backflow Preventers**

Reduced pressure backflow preventers shall be installed above ground. The unit should be placed at least twelve inches (12") above the finish grade to allow clearance for repair work. A concrete slab at finish grade is recommended.

Reduced pressure zone assemblies shall not be installed in any below-grade pit or vault.

#### **19.04.7 Waterline Flushing**

Before installing an approved backflow prevention assembly, pipelines must be thoroughly flushed to remove foreign material.

### **19.05 Testing and Reporting**

#### **19.05.1 Testing requirements**

Backflow prevention assemblies are required to be tested at the time of installation, repair

or replacement, and on an annual basis thereafter. Such tests shall be conducted in accordance with City Code 138-170.

All testing equipment used in the testing of backflow prevention assemblies shall be checked for accuracy yearly, or more often, and proof of compliance shall be submitted to Aurora Water annually, or upon request.

Aurora Water retains the right to check the installation and operation of any containment assembly at any time to ensure proper operation.

Backflow prevention assemblies shall be returned to service by the technician performing the test at the completion of the test.

#### **19.05.2 Reporting, Record-keeping Duties and Requirements**

The certified cross-connection control technician shall submit test results online at the "[Backflow Site](#)" prior to the annual test due date, and within five (5) working days of following the completion of the test or maintenance of the assembly. Contact [backflow@auroragov.org](mailto:backflow@auroragov.org) to set up an online account. The certified cross-connection control technician shall also attach a tag to the backflow prevention assembly following each test or maintenance activity to document and date the activities performed. Records of all tests or maintenance activities, including materials and parts changed, shall be kept by the certified cross-connection control technician, the property owner, and Aurora Water for a period of not less than three (3) years.



## **SECTION 20.00 CORROSION CONTROL FOR WATER PIPE**

- 20.01 Soil Resistivity Measurements
- 20.02 Anode and Test Site Installation
- 20.03 Corrosion Control for Special Situations and Appurtenances
- 20.04 Corrosion Design for 16 Inch and Larger DIP and Steel Lines
- 20.05 Ductile Iron Pipe
- 20.06 Steel Pipe
- 20.07 Electrical Grounding and High Voltage Power

## **SECTION 20.00 CORROSION CONTROL FOR WATER PIPE**

### **20.01 Soil Resistivity Measurements**

Soil resistivity measurements shall be taken by an independent geotechnical laboratory and tested according to ASTM G57-06, *Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method*. Results shall be submitted to Aurora Water Engineering for all projects requiring public water main extensions. Soil testing frequency shall not be less than one (1) test for every two hundred fifty feet (250) lineal feet of pipe (or fraction thereof). Soil testing shall be conducted at the approximate depth of pipe construction. These tests are required to accurately determine the appropriate pipe material and cathodic protection needed for each installation. Furthermore, additional corrosion protection may be required for each specific project with sixteen inch (16") and larger DIP and all-size steel.

### **20.02 Anode and Test Site Installation**

#### **20.02.1 Anodes**

Anodes shall be installed as specified for each particular installation and according to these specifications. Anodes shall be installed by the thermite weld process with a #12 copper sleeve properly attached to the wire before weld process. The anode lead wire shall be placed in a way which does not strain the connection during backfilling and compaction. Anode leads shall be solid copper #12 American Wire Gauge (AWG) Thermoplastic High Heat-resistant Nylon-coated (THHN) or Thermoplastic High Water-resistant Nylon-coated (THWN) insulated wire twenty feet (20') in length to allow sufficient slack and flexibility during installation. Anodes shall be installed at a depth below the bottom of the pipe and preferably at least five feet (5') away from the pipe. However, in special situations, they may be placed a minimum of three feet (3') from the pipe as approved by the City of Aurora's cathodic protection personnel. Anodes shall be backfilled with native soil and soaked with a minimum of five (5) gallons of water before backfilling.

#### **20.02.2 Test Sites**

Test sites shall be installed as specified for each particular installation and according to Standard Detail #218. Test wires shall be #12 AWG SOLID THHN wire black in color. They shall be installed in the same manner as the anodes and bond wires with a #12 copper sleeve attached to the wire before weld process. Sufficient slack shall be left in the wires to avoid any strain on the thermite weld. The test wires shall run to the surface and shall be installed in a standard sixteen inch (16") inch cast iron valve box with a cast iron lid stamped "CP Test", Tyler 6860 Series, sixteen inch (16") Valve Box or approved equal. Different color test wires shall be used for foreign lines, casings, etc. No splices or nicks in the wire or coating shall be allowed for either the anode lead wires or test wires. Twelve inches (12") of slack shall be left in the test box at the surface. The test box shall be installed level with finished grades and each test site wire shall be permanently tagged in the box with a permanent identification marker.

#### **20.02.3 Joint Bonding**

Piping will be installed with two -#2 AWG, unless noted otherwise, stranded HMWPE insulated bonding wires at each joint and appurtenance. Bonds will be installed by

thermite weld process and will be continuous for the entire length needed (no splice). The proper sleeve shall be crimped onto the wire before being welded.

#### **20.02.4 Post Mounted Test Stations**

In areas out of the street and not paved, and not subject to high foot traffic, post mounted test stations shall be used in lieu of flush mounted test stations. Post mounted test stations shall be rectangular shaped cast aluminum test boxes a minimum of four inches (4") by eight inches (8") by two inches (2") deep. Post mounted test stations shall be provided with a minimum of five (5) terminals mounted on a plastic or glass reinforced laminate terminal block. Terminals shall be stainless steel, brass or bronze. Test station boxes shall be mounted on a minimum five foot (5') long threaded one and one quarter inch (1¼") rigid steel galvanized steel conduit and installed with a galvanized steel channel for support and protection. The galvanized steel C channel shall be a minimum of six feet (6') long and seven inches (7") wide by two inches (2") deep. The conduit shall be attached to the channel with U-bolts set a minimum of one and one half feet (1½') apart. Test station shall be installed with the top of the test box approximately two and one half feet (2½') to three feet (3') above the surface. See Appendix B, Approved Materials List, for acceptable post mounted test stations. Test sites outside the street area shall be marked by a blue marking post or with a City of Aurora Test Site sticker on the post.

#### **20.02.5 Thermite Welding**

All wires installed by the thermite weld process shall be checked for proper installation. The weld material shall be contained on the wire and mold area without excessive runs. Each wire shall have a properly sized sleeve installed before welding and crimped to the wire with the proper equipment. The wire shall be trimmed of insulation only to the point of allowing proper installation of the crimped sleeve. No nicks in the wire or coating shall be allowed. Thermite welds and molds shall be properly sized for the wire and sleeves. The pipe shall be cleaned to shiny metal before wire installation. All welds shall be tested by a sharp rap with a hammer to ensure the weld is secure. All welds shall be cleaned of slag, primed with spray primer, and covered with an approved capping product listed in Appendix B, Approved Materials List according to the manufacturer's recommendations. At the start of each project the Contractor shall designate personnel demonstrating the ability to prepare and install bonds, anodes and test wires to the satisfaction of the COA cathodic protection personnel. These personnel shall then be considered the competent persons on site to perform the above work and shall be the only people allowed to perform the installations. If they are unavailable, replacement personnel must demonstrate their competency before being allowed to perform the above installations. Joints utilizing MegaLugs do not require joint bonding.

#### **20.02.6 Continuity Testing**

The Contractor shall be responsible for performing all continuity testing on bonded pipelines using methods approved by the City of Aurora cathodic protection personnel. Testing shall be performed by the Lineal Pipe Resistance Test Method by a qualified NACE Accredited Senior Corrosion Technologist, Cathodic Protection tester, Cathodic Protection Specialist, or Corrosion Specialist. A record of all tests shall be furnished to the City upon completion of the project. Any breaks in the continuity or broken bond

wires shall be repaired and all records furnished before a notice of final completion is issued. City of Aurora personnel shall observe the testing procedures to verify the results.

## **20.03 Corrosion Control for Special Situations and Appurtenances**

### **20.03.1 Dissimilar Metals and Connection to Existing Metallic Infrastructure**

All tie-ins to dissimilar metals or existing metallic infrastructure shall be dielectrically isolated by means of insulating flange kits, insulated dressers, isolation couplings or dielectric couplings etc. All isolating devices shall be properly installed per manufacturer recommendations and tested to ensure proper function. The use of an insulation checker is preferred, or application of sufficient direct current to one side of the device, to shift the potential approximately one hundred (100) millivolts without shifting the structure on the other side of the device. The Contractor shall not bury any dissimilar metallic connections until visually inspected and the testing verified by COA cathodic protection personnel. Aurora Water personnel may perform their own tests to confirm proper function of the device. Test wires shall always be installed on either side of the isolation device and clearly marked as to which side for future use in monitoring the device.

### **20.03.2 Restraining Rods and Bolts, Flanged Joints**

Restraining rods shall be wrapped in polyethylene sleeving for protection. Any restraining rod in contact with concrete such as thrust blocks, wall penetrations, etc. must be electrically isolated from the piping. Any restraining rods installed across an insulating device at dissimilar metals or existing metallic infrastructure must be isolated as well. One piece sleeve and washers from an insulating flange kit shall be used to isolate the rods at the fittings. Flange-to-flange fittings shall utilize one piece sleeve and washers with the washer placed on the unprotected flange.

### **20.03.3 Thrust Blocks and Flow Fill**

Concrete thrust blocks in contact with the pipe should be installed in such a manner as to not damage the pipe coating in anyway. All steel pipe coating shall be holiday tested upon installation and concrete shall not be dumped directly onto the pipe unless a rock shield product or equivalent is installed on the pipe. Ductile pipe shall be double polywrapped at the thrust block and a minimum of two feet (2') on either side. Any areas where flow fill or ash fill is used shall have approved backfill placed a minimum of one foot (1') over the pipe before pouring the flow fill or ash fill.

### **20.03.4 Bore Casings and Skids**

See Standard Detail #107 for bore casing thickness, diameters and approved models of casing skids. Bore casings under existing structures shall be uncoated bare steel. Casing pipe anodes are installed as needed per design where the casing is installed in an open cut for future projects.

Ductile pipe shall be polywrapped and the casing skids installed at locations per the Manufacturer's recommendation over the polywrap. Approved casing end seals shall be installed at each end of the casing. Casing fill material is required and shall be clean, dry sand or approved grout or hot wax.

### **20.03.5 Bridge Crossings**

Whenever a water main is suspended from a bridge deck, pipe shall be designed so no water from the bridge drips directly onto the pipe. The main shall also be completely insulated from the bridge deck support hangers as necessary.

### **20.03.6 Epoxy Coatings on Valves, Hydrants, and P.R.V.'s**

The interior of all valves, hydrants and P.R.V.'s shall be coated with a potable water epoxy as approved by N.S.F. and per AWWA Standard C550. In addition the exterior of all P.R.V.'s and check valves shall be epoxy coated except where P.R.V.'s are stainless steel.

### **20.03.7 Coatings in Vaults and Manholes**

All bare steel and ductile piping, connections, fittings and appurtenances in vaults or manholes shall be coated with cold applied petrolatum tape or petrolatum wax tape. Installation shall follow the AWWA recommendation C217-95 for buried steel pipelines but shall apply to ductile and steel piping.

## **20.04 Corrosion Design for 16 Inch and Larger DIP and Steel Lines**

Cathodic protection design may be performed by a NACE International certified specialist or engineer with the express written approval of Aurora Water. All cathodic protection designs will be reviewed by Aurora Water cathodic protection personnel.

## **20.05 Ductile Iron Pipe**

### **20.05.1 Tapping Procedures**

Any taps performed on these pipelines shall be done per Ductile Iron Pipe Research Association (DIPRA) and AWWA recommendations either by direct tapping or with approved saddles. All services shall be isolated from the main.

### **20.05.2 V-Bio Enhanced Polyethylene**

All ductile pipe and fittings installed in the system shall be wrapped with V-Bio Enhanced polyethylene composed of virgin polyethylene unless noted otherwise in the project drawings and specifications. V-Bio shall be installed according to DIPRA recommendations and AWWA C105/A21.5-93 method 'A'. Care shall be taken to insure all rips and tears are properly repaired. Care shall be taken to avoid damage to the V-Bio during backfill and compaction.

### **20.05.3 Anode and Test Site Installation**

See Section 20.02

### **20.05.4 Appurtenances Requiring Continued Continuity**

Appurtenances such as valves, flanges, solid sleeves, etc. shall be double bonded according to the joint bonding procedures unless they are metallically connected by other means. If used, dressers shall have an additional bond wire across the dresser and across the gasket flange. All appurtenances shall be wrapped per AWWA C105/A21.5-93 Section 4.3.3 and 4.3.4. Any buried flanged blow-off piping shall have heat shrink sleeves per Appendix B: Approved Materials List, installed on the flanged portion to protect the bolts. All blow-off piping shall be wrapped. Dresser Couplings shall be used

on steel pipe only. Solid sleeve couplings with spacer rings shall be used for all other pipe materials.

#### **20.05.5 Tie-ins to Dissimilar Metals**

See Section 20.03.1.

#### **20.05.6 Continuity Testing**

See Section 20.02.6.

#### **20.05.7 Joint Bonding**

Piping will be installed with two #2 AWG, unless noted otherwise, stranded HMWPE insulated bonding wires at each joint and appurtenance where required. Bonds will be installed by the thermite weld process and will be continuous for the entire length needed (no splice). A proper sleeve must be crimped onto the wire before being welded.

#### **20.05.8 Cathodic Protection**

Cathodic protection may involve either the installation of impressed current systems or sacrificial anodes. Cathodic Protection systems will be designed and installed on a specific project basis. All of the following information on anode installation is based upon the installation of a sacrificial anode system. Test site installation is the same with either system. Impressed current systems are a more specialized installation and specifications will be provided by City of Aurora Corrosion Protection Personnel.

### **20.06 Steel Pipe**

#### **20.06.1 Tapping Procedures**

All taps on steel pipelines shall be weld-on and performed by City of Aurora personnel. All taps shall be dielectrically insulated from the main.

#### **20.06.2 Coatings**

Steel pipe shall be coated with polyurethane per Appendix B: Approved Materials List. Joint connections shall be covered with heat shrink sleeves. Any flanged and/or bolted connections such as blow-offs shall be poly wrapped.

If direct bury or inside a vault, bolts, fittings and pipeline shall be coated with wax or petrolatum tape per AWWA C217 and as specified by design plan

Any coating repairs shall be compatible with the shop-applied coating system. For polyurethane coatings holidays and small repairs can be made with melt stick materials with proven adhesion and compatibility with polyurethane coatings (see Appendix B: Approved Materials List). Larger repairs can be made with single use kits of the same material as the coating or with spray applied coatings of the same material.

#### **20.06.3 Appurtenances**

Appurtenances such as valves, flanges, solid sleeves, etc. shall be double bonded similar to the pipe joint bonding procedures unless they are metallicity connected by other means. If used, dresser style couplings and solid sleeves shall have an additional bond

wire across the dresser and across the gasket flange. All appurtenances on steel pipe shall be primed and coated in the same manner as the joints. Any buried flanged blow off piping shall have heat shrink sleeves installed on the flanged portion to protect the bolts. All blow-off piping shall be primed and coated if steel.

#### **20.06.4 Holiday Testing**

Holiday testing on coated steel pipe shall be performed both at the manufacturing facility and in the field just before pipe installation. Proper equipment and voltage levels recommended by the manufacturer for the specific coating and thickness being tested shall be used. The equipment shall be in proper working order, properly grounded, and all manufacturers recommendations followed. Testing shall be according to AWWA C209-95 Section 5.2 and results will be supplied to COA personnel.

#### **20.06.5 Soil Resistivity Measurements**

Soil resistivity measurements will be taken by City of Aurora personnel or independent geotechnical laboratory and utilized in the design of the cathodic protection system for each specific project.

### **20.07 Electrical Grounding and High Voltage Power**

#### **20.07.1 Electrical Grounding**

Any electrical attachment to the pipe such as at electric valve actuators, gauges, pumps, treatment plants, etc. must be isolated from the buried piping. Insulated flanges inside the building or vault structure shall be installed past the electrical attachment to isolate the pipe from the attachment. All wall penetrations shall be made utilizing sleeves and link seals or equivalent devices to ensure that the pipe is isolated from the concrete, rebar, and any electrical grounding hooked to the rebar. Test sites shall be installed directly outside the exit from the building or on both exits from vaults with electric controls for future use in monitoring the isolation devices. Properly sized and type of dairyland couplings shall be included in areas where the chance of electrical shock exists but continued cathodic protection is desired.

#### **20.07.2 Foreign Cathodic Protected Line Crossings**

Underground utility lines installed with an impressed current cathodic protection (ICCP) system and that parallel with limited separation, or cross directly over a City owned buried metallic structure (pipeline, reinforced steel vault, etc.) are required to provide a written engineering analysis of the design provisions to appropriately mitigate stray current interference. If it is determined that stray current mitigation equipment installation on the existing City structures is required, all corresponding design documents should be supplied to Aurora Water personnel for approval. All costs associated with the design and installation are the responsibility of the utility owner and not the responsibility of Aurora Water, unless otherwise negotiated with the City.

A written notice should be provided to the City forty-eight (48) hours prior to both construction work and stray current mitigation system testing performed on the identified City property. Should the City elect, this work should be conducted with an Aurora Water and/or a designated representative on site for observation. A report verifying the

effectiveness of the new mitigation design should be provided, and signed off by the City prior to the commencement of the utility's operation.

### **20.07.3 High Voltage Buried and Overhead Power Lines**

Buried high power electric lines which cross City of Aurora water lines at a perpendicular angle shall have a minimum clearance of three feet (3') between structures. If this is not possible, an insulating shield shall be placed between the structures. Shield type and distance shall be determined based on the specifics of the situation. Buried high power lines running parallel to City of Aurora water lines shall have a minimum of four feet (4') of clearance both horizontally and vertically from the water line.

A continuously bonded water line running parallel to buried or overhead high power lines shall require test sites to be installed. Anodes may have to be installed to monitor and possibly provide for drain points for induced alternating current build up on the water line. This must be addressed on a specific case by case basis at installation. Smaller DIP lines may have to be bonded and anodes installed depending on the specific situation or PVC pipe may be required in its place.



## **SECTION 21.00 SANITARY SEWER PIPE INSTALLATION**

- 21.01 General
- 21.02 Progression of Work
- 21.03 Line and Grade
- 21.04 Cradles and Encasements
- 21.05 Tees, Wyes, and Risers
- 21.06 Cleaning the Line
- 21.07 Testing and Inspection

## **SECTION 21.00 SANITARY SEWER PIPE INSTALLATION**

### **21.01 General**

Unless otherwise specified, all pipe handling, laying and jointing shall be based upon manufacturers' recommended practice for installation of each specified type of pipe. Provisions of this section shall supersede and augment those recommendations.

**All PVC and HDPE pipe used for Sewer or Force Main applications shall be installed with an electronic marker system for locating purposes per Section 14.07.3. Tracing wire is not allowed. Spigot shall not be inserted in the bell past the home line indicated on the spigot or the installation shall be rejected.**

### **21.02 Progression of Work**

The laying of pipe shall commence at the lowest point and proceed upgrade so the pipe is laid with the bell ends facing upstream and at the correct grade and alignment. A plug shall be placed and maintained in watertight condition where a new line is connected to an existing sewer main during construction. The pipe shall be placed so the specified bedding provides a solid, uniform bearing surface for the full length of the barrel. Bell holes shall be provided at all joints. Equipment used in handling and jointing the pipe shall have adequate capacity to handle the pipe smoothly and ensure proper closure of joints.

All pipe shall be carefully constructed so when joined they will form a conduit with a smooth, uniform invert. The pipe shall be laid accurately to the grade and alignment specified on the drawings. Blocking or wedging of the pipe to achieve proper positioning and grade shall not be permitted, except where required for proper construction of cradles or encasements.

Sanitary sewer main shall be installed with Class B Alternate bedding.

Clean-outs shall not be allowed as a substitute for manholes on sanitary sewer mains.

### **21.03 Line and Grade**

All piping shall be constructed to the lines and to the grades and elevations shown on the approved drawings. Laser devices or grade stakes shall be used to maintain proper grades. Grade stakes at a minimum spacing of twenty-five feet (25') shall be used for grades less than 0.40%.

### **21.04 Cradles and Encasements**

See Section 11.08 of these specifications.

### **21.05 Tees, Wyes, and Risers**

The Contractor shall place tees, tee-wyes, stubs, and risers where required by the approved construction plans. Wyes shall be used only for service to lots at the back of a cul-de-sac. Tees shall be angled upwards so the upper invert of the forty-five degree

(45°) bend connected to the fitting shall have an elevation equal to or higher than the inside crown of the sewer main. Watertight plugs shall be installed and maintained in each branch pipe or stub until the service connection is made. Tee and riser locations shall be marked with steel 'T' posts or wooden 4X4's. See Section 23.00 for details on service stub-ins and house service connections.

When a service line connects to an existing main that has been provided a CIPP liner, the host pipe shall NOT be removed to facilitate the connection. The saddle shall be connected directly to the host pipe.

## **21.06 Cleaning the Line**

When all of the pipes have been installed, the line and manholes shall be cleaned and be free of sand, dirt and debris. If the line must be flushed, it shall be done by use of a high-pressure jet or sewer balling method. Care shall be taken to ensure no sand, dirt and/or debris enters the existing sanitary system during the flushing operation. Should the Contractor allow deleterious material to enter and damage the existing system, costs of removing sand and dirt from the system, and any fines according to City Code will be at the Contractor's expense.

Removal of any material or debris entering the sanitary sewer main as a result of construction activities causing a disruption of flow or stoppage shall be the responsibility of the Contractor. This shall include cleaning and restoration of all affected residences and businesses.

## **21.07 Testing and Inspection**

Sanitary sewer lines shall pass the following tests before initial acceptance as specified.

### **21.07.1 Water Tightness**

A test for water tightness of the sewer line and its appurtenances may be required under the supervision of the authorized representative of the Engineer. The sewer pipe, all connections, and all appurtenances shall not leak under normal external ground water pressure more than fifty (50) gallons per inch of inside diameter per mile of sewer per twenty-four (24) hours. Leakage shall be measured between consecutive manholes, and shall not exceed the limit of infiltration between any two (2) manholes. Sections of pipe having infiltration rates above the maximum shall be repaired or replaced at the Contractor's expense. The system must not leak with a six foot (6') head of internal pressure. The loss of water from any portion of the completed sewage system shall be investigated and immediate measures taken to correct the loss.

Force Mains shall be hydraulically tested for water tightness. The main shall be subject to a test pressure no less than the operating pressure for the system. Operating pressure shall include the pumping head plus one hundred (100) psi surge pressure. This information shall be provided on the approved project drawings.

### **21.07.2 Low-Pressure Air Test**

On all sanitary sewer lines (plastic composite and ductile iron), including private sewer lines, the Contractor shall conduct a line acceptance test using low-pressure air testing. PVC pipelines test in accordance with ASTM F1417-98 and UBPPA UNI-B-6.

The Contractor shall furnish all labor, equipment, and any appurtenant items necessary to satisfactorily perform the vacuum test. All testing equipment shall be approved for vacuum testing manholes.

#### **21.07.2.1 Air Test Procedure (Dry Conditions)**

The following procedure shall be used during the low-pressure air testing of sewer mains located above the ground water table: Isolate section of sewer by inflatable stoppers or other suitable test plugs. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test. Securely brace all plugs or caps to prevent blow-out. One of the plugs or caps should have an inlet tap, or other provision for connecting a hose to a portable air source.

Connect the air hose to the inlet tap. Add air slowly to the test section until the pressure inside the pipe reaches 4.0 psig.

Allow the pressure to stabilize such that a pressure between 4.0 psig and 3.5 psig is maintained for at least two minutes. The pressure will normally drop slightly until equilibrium is obtained; however a minimum of 3.5 psig is required.

Disconnect the air supply and decrease the pressure to 3.5 psig. before starting the test. Use the Time-Pressure Drop Method to determine if the segment of pipe is "Acceptable". Determine the minimum acceptable time for a 1 psig drop in pressure from 3.5 psig to 2.5 psig. Compare the minimum acceptable time to that actually observed in the field to determine if the rate of air loss is within acceptable limits. Minimum holding times are listed in the following table depending on length and size of mains.

Minimum specified time required for a 1.0 psig pressure drop for size and length of pipe

Pipe Diameter (inches)	Specification Time for Length Shown (Minutes : Seconds)							
	100ft	150ft	200ft	250ft	300ft	350ft	400ft	450ft
8	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	14:10	17:48	22:15	26:42	31:09	35:35	40:04
18	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33

### 21.07.2.2 Air Test Procedure (Wet Conditions)

All test pressures are measured as gage pressure, which is any pressure greater than atmospheric. Since water produces a pressure of 0.43 psig for every foot of depth over the main, air test pressures must be increased to offset the depth of ground water over the sewer line.

In areas where groundwater is known to exist, the contractor shall install a one-half inch diameter capped PVC pipe nipple, approximately 10" long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to performing the line acceptance test, the ground water elevation shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in the plastic tube.

Multiply the height in feet above the pipe invert to the ground water table by 0.43 psig/ft and add it to the required 3.5 psig minimum test pressure. For example, if the height of water is 11.5 ft, then the added pressure will be 0.43 psig/ft x 11.5 ft or 4.9 psig. This increases the test pressure from 3.5 psig to 8.4 psig and the 2.5 psig to 7.4 psig, respectively. The allowable drop of 1 psig for the time allowed as outlined in Table 1 still remains the same. If however, the ground water level is 2 ft or more above the top of the pipe at the upstream end, or if the air pressure required for the test calculates out to be greater than the 9 psig gage, the air test method should not be used. In these case, a visual inspection for leakage would produce a more conservative test. Before the air test method is used, the ground water level should be lowered by pumping or dewatering.

Equipment systems used to perform low-pressure air tests shall be specifically designed for this purpose. Isolation of pipe segments shall be accomplished through the use of plugs (mechanical or pneumatic type). Pressurization of the sewer main shall be accomplished through the use of an air compressor that has an oil free air source, singular control panel, main shut-off valve, pressure-regulating valve, 9 psig pressure relief valve, input pressure gauge, and a continuous monitoring pressure gage. The continuous

monitoring pressure gage shall have a pressure range from 0 psig to at least 10 psig with minimum divisions of 0.10 psig. The gage face shall be a minimum of 4 inches in diameter and have an accuracy of + .04 psig.

All sanitary sewer manholes constructed by the Contractor shall be vacuum tested for leakage in the presence of an inspector. Vacuum testing shall be performed in accordance with ASTM C1244. The vacuum test requirement will not apply to any existing manhole, or any existing manhole that has been converted to a drop manhole by the Contractor.

The Contractor shall furnish all labor, equipment, and any appurtenant items necessary to satisfactorily perform the vacuum test. All testing equipment shall be approved for vacuum testing manholes.

### **21.07.2.3 Vacuum Testing Procedure**

All lifting holes shall be plugged with an approved non-shrink grout inside and out. Manhole joints shall be grouted from the outside only. All pipes entering the manhole shall be plugged. The Contractor shall securely brace the plugs in order to keep them from being drawn into the manhole. The test head shall be placed at the inside of the top of the cone section of the manhole and the seal inflated in accordance with the manufacturer's recommendations.

A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time for the vacuum to drop to 9 inches of mercury shall not be less than that shown in the table below:

DEPTH (FEET)	MANHOLE DIAMETER (INCHES)		
	48	60	72
0-8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

Times shown are minimum elapsed times, in seconds, for a drop in vacuum of 1 inch of mercury.

### **21.07.2 Visual Inspection**

All sanitary sewer line construction will be visually inspected for conformance to approved civil drawings by the Inspector. This inspection will include, but not be limited to, bedding,

alignment, elevation, infiltration, misalignment, broken pipes and other deficiencies. Defects noted during inspection shall be repaired to the satisfaction of the Engineer.

### **21.07.3 Deflection Test**

A deflection test shall be required for all sewer piping. A GO-NO-GO Mandrel shall be pulled through the pipe a minimum of 60 days after the final placement of backfill and superimposed loads. The deflection of the sewer pipe shall not exceed 5.0 percent when tested with a mandrel specifically designed for the type and size of pipe installed. Pipe segments failing the Mandrel test shall be removed and replaced.

Because the inside diameter of composite plastic piping varies from that of solid wall PVC, equipment systems used to perform Mandrel tests shall be specifically designed for the pipe material being tested. Mandrels that do not specifically state the size and type of piping for which it is applicable shall not be allowed.

### **21.07.4 Televised Inspection**

The Contractor is responsible for scheduling and conducting Closed Circuit Television (CCTV) inspection of the pipe after construction. CCTV camera must be designed for sewer main inspection and fitted with either a track or wheels (Push cameras are not allowed). CCTV inspection must be performed by a NASSCO PACP certified contractor with water flowing through the pipe, or with camera equipped with an inclinometer. Assets called out on the CCTV shall be identified in accordance with the executed utility extension agreement. The CCTV inspection shall be performed after the line is cleaned and will be rejected if the water is turbulent or if hydraulic cleaning (jetting of the pipe during inspection) is recorded. CCTV records shall be provided to Aurora Water, Wastewater office (13646 E. Ellsworth Ave. Aurora, 80012) by electronic format, preferably USB portable storage device. Any defects discovered during review of the televised inspection will be supplied to the Contractor in writing and corrected to the satisfaction of the Engineer.

**The Contractor shall schedule reinspection via CCTV of the completed main prior to placing the main in active service at the completion of paving operations, if necessary as required by Aurora Water.**

Initial Acceptance or notice of discrepancies will be issued within seventy-two (72) business hours of receipt of CCTV record by the Wastewater Division.

### **21.07.4 Test Failure and Repair Procedure**

Should a line or manhole fail to pass any of the acceptance testing as outlined, the Contractor shall, at his expense, determine the source of the failure, make any necessary repairs, and retest the segment of piping or manhole in question at no cost to the City.

Joints allowing infiltration or exfiltration shall be replaced until the pipe is deemed watertight. Pipes with structural damage shall not be collared or grouted, but shall be replaced. The Contractor shall notify the Inspector twenty-four (24) hours in advance of any repair work to the completed main.

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## **SECTION 22.00 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER LINE**

- 22.01 General
- 22.02 Diameter of Pipe
- 22.03 Wall Thickness Design of Pipe
- 22.04 Fittings and Specials
- 22.05 Joints
- 22.06 Pipe Lengths
- 22.07 Markings on Pipe
- 22.08 Deep Sewers
- 22.09 Channel Crossing
- 22.10 Encasement
- 22.11 Casing
- 22.12 Bores

## **SECTION 22.00 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE**

### **22.01 General**

All materials, manufacturing operations, testing and inspection of PVC Sewer Pipe shall be in conformity with the requirements of ASTM D3034-SDR-35 for four inch (4") to less than eighteen inches (18") inch PVC. Requirements shall be in conformity with ASTM F679 for eighteen inch (18") inch to twenty-seven inch (27") PVC. PVC pipe greater than twenty-seven inch (27") in diameter shall be considered on a case by case basis. Individual applications shall be reviewed and approved by Aurora Water specifically for the proposed application. Profile wall PVC shall be in conformity with the requirements of ASTM F794.

**All PVC SEWER pipe shall be installed with an electronic marker system for locating purposes per Section 14.07.3. Tracing wire is not allowed. Spigot shall not be inserted in the bell past the home line indicated on the spigot or the installation shall be rejected. Joint deflection on PVC pipe is not allowed without the approval of Aurora Water Engineering and shall not exceed manufacturer's recommendation.**

### **22.02 Diameter of Pipe**

The diameter indicated on the approved construction drawings shall mean the nominal inside diameter of the pipe.

### **22.03 Wall Thickness Design of Pipe**

The standard dimension ratio of the diameter to the wall thickness shall be ASTM D3034-SDR35/SDR-26.

### **22.04 Fittings and Specials**

All fittings and specials shall conform to the requirements set forth in ASTM D3034-SDR-26 or ASTM F679 and shall have the same structural properties and the same bell and/or spigot configurations as an adjoining pipe.

### **22.05 Joints**

All PVC joints shall be of bell and spigot type. The bell shall consist of an integral wall section. The rubber ring shall be in accordance with ASTM F477. The joint shall meet the requirements of ASTM D3212. Spigot ends shall be smooth and free of burrs prior to making the joint. A lubricant, as specified by the pipe manufacturer, shall be applied to the spigot end to prevent damage to the ring and aid in making a tight joint.

### **22.06 Pipe Lengths**

Pipe sections shall be furnished in lengths no shorter than twelve and one half feet (12½') feet except service tees and closure pieces. The maximum pipe length shall be twenty feet (20').

## **22.07 Markings on Pipe**

PVC Sewer Pipe shall be any color other than blue or purple to distinguish the sewer pipe from water conduits except when AWWA C900 PVC is required by the Engineer. Each pipe shall be marked by the manufacturer with the appropriate ASTM designation. Any pipe or fittings not properly marked shall be rejected and removed from the job site. All pipe ends shall be capped at the factory prior to being shipped. Pipe arriving onsite without the ends capped shall be rejected. Pipe shall be stored in a way that shall protect the pipe from damage due to exposure to sunlight. Pipe discolored to any extent shall be considered as having sunburn damage and shall be rejected and removed from the project.

## **22.08 Deep Sewers**

ASTM D3034-SDR-26 shall be required when a sanitary main must be installed with a bury depth greater than fifteen (15) vertical feet. AWWA C900 PVC shall be required if the bury depth increases to twenty (20) vertical feet.

## **22.09 Channel Crossing**

AWWA C-900 PVC shall be used at all channel crossings. Crossings shall be designed with sufficient clearance for scour potential on the channel based on flows and soil classification. Aurora Water reserves the right to require concrete encasement or sleeving for a sanitary sewer crossing of an open channel.

## **22.10 Encasement**

A water main crossing over a sanitary main must provide a clearance of twenty-four (24) inches. Concrete encasement of the sanitary sewer shall be required if the clearance is less than twenty-four inches (24") and shall be installed per these specifications. Encasement shall extend ten feet (10') either side of the crossing for a total length of twenty feet (20').

Sanitary mains and services are not allowed to cross over water lines without the approval of the Engineer and site specific design of the crossing. Concrete encasement of the sanitary sewer main is required any time the main crosses over a potable water main per these specifications.

## **22.11 Casing**

The sanitary main shall be provided a casing for any storm culvert crossing in excess of thirty-six inches (36"). The casing pipe shall be designed with sufficient length as to provide a 1:1 excavation of the culvert without undermining the sanitary main.

## **22.12 Bores**

All sanitary mains requiring a directional bore shall be constructed per these specifications. Approved casing chucks shall be required at specified locations around the pipe based on the diameter of the carrier pipe and in conformance with the manufacturer's recommendation. All joints shall be fully restrained within the casing pipe.

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## **SECTION 23.00 SANITARY SEWER SERVICE LINE CONSTRUCTION**

- 23.01 General
- 23.02 Materials
- 23.03 Location and Alignment of Service
- 23.04 Service Line Installations
- 23.05 Tapping the Main
- 23.06 Clean Outs
- 23.07 Service Stub-In to Property Line
- 23.08 Sidewalk or Curb Crossing
- 23.09 Trench Backfilling
- 23.10 Inspection
- 23.11 Maintenance of Traffic
- 23.12 Warranty of Work
- 23.13 Discontinuation of Sewer Service

## **SECTION 23.00 SANITARY SEWER SERVICE LINE CONSTRUCTION**

### **23.01 General**

All sanitary sewer service lines which connect to the City of Aurora sanitary sewer system shall adhere to this section and Section 22.00 of these specifications.

**Two-way cleanouts are required for all new and repaired private sanitary sewer service laterals per these Specifications and Standard Details.**

### **23.02 Materials**

#### **23.02.1 PVC Pipe**

PVC pipe used for sanitary sewer services shall meet or exceed ASTM D3034-SDR35 or SDR-26. All joints shall be watertight. Fittings, saddles, bends, etc. shall be PVC type or other materials as approved by the Engineer. Glued joints shall not be allowed beyond five feet (5') feet from the foundation. Down gradient from this point only gasket joints shall be used in the service line. Pressure rated PVC pipe can be used up to, but no more than, five feet (5') outside of the foundation wall for connection to the SDR-35 pipe.

All pipes shall be subject to inspection upon delivery to the job site. Plastic joint material damaged in any way shall be cause for rejection of the pipe.

#### **23.02.2 Ductile Iron Pipe**

Ductile iron pipe shall be installed where required on the plans and as required by the Inspector. The materials shall conform to Section 12.00 of these specifications. All joints shall be watertight.

### **23.03 Location and Alignment of Service**

Sanitary sewer service lines shall be constructed on the shortest and straightest route possible. At no time shall service lines be any closer than five feet (5') to the side property line, and no service line may be constructed through or in front of any adjoining property. Typically, the service line shall be located five feet (5') toward the low side of the lot from the centerline of the lot and at least ten feet (10') horizontally from the water service line.

### **23.04 Service Line Installations**

The minimum diameter of service lines is four inches (4"). In general, all installation work shall conform to applicable portions of ASTM C12 and to the pipe manufacturer's installation instructions.

Pipe shall be laid according to these specifications. Sewer and water service lines must be a minimum of ten feet (10') apart horizontally. Concrete encasement of the sewer line shall be required if minimum clearances cannot be maintained. The pipe shall be protected from damage at all times. The grooves shall be cleaned to be free from all foreign materials before assembling the joint. The pipe shall be laid with the spigot ends pointing in the direction of flow. All joints shall be watertight. The joining of dissimilar materials like PVC pipe to VCP pipe shall be done by means of an adapter specifically designed for the connection encased in concrete or other method approved by Aurora

Water Engineering. Trenches shall be kept free of water during laying and jointing. The minimum grade for a four inch (4") line shall be two percent (2%) or one fourth inch (¼") per foot.

The Inspector shall have the authority to require that the exact grade of the line be determined before backfilling the trench.

Care shall be taken to insure that any repair of a sanitary sewer service lateral does not protrude into the public collection main, especially when trenchless methods are used. A CCTV inspection at the point of connection is required to be submitted to Aurora Water when trenchless methods are used for the repair.

## **23.05 Tapping the Main**

### **23.05.1 General**

A manhole shall be installed in place of a saddle tee, whenever the diameter of the service line is equal to or greater than seventy-five percent (75%) of *an existing* sewer main. Direct service line taps may be made on existing mains smaller than twenty-four inches (24") in diameter. The Inspector shall inspect the main, the saddle, and the service line for new and repaired buildings at every tap or tee before backfilling.

Inspection of sanitary sewer service is required by Aurora Water. It may be scheduled after applicable fees are paid. In the event the tap and service line are covered before it is inspected, it shall be re-excavated by the Contractor, and cleared allowing for visual inspection of the tap and main. If the sewer main is cracked or broken during the process of locating or tapping, it shall be repaired immediately by replacing the broken section at the Contractor's expense. Wyes shall be used only for service to lots at the back of a cul-de-sac and connected to a stub-out upstream of a manhole.

Service lines shall not empty directly into a manhole unless the manhole has been specifically and exclusively constructed for the service line. Service lines four inches (4") in diameter are not allowed to discharge into a public manhole.

### **23.05.2 V.C.P. Mains**

Where tees have not been installed in the main sewer, the main shall be tapped by a machine drilling a hole the size to fit the saddle for the service line. The Inspector shall approve the drilling machine and method of drilling.

### **23.05.3 PVC Mains**

Where PVC tees have not been installed in the main, a PVC saddle tee shall be installed according to the manufacturer's recommendations and these specifications. A keyhole, saber saw or shell cutter shall be used to cut a round hole in the PVC main. The tapping saddle or connection shall not protrude into the main. All edges shall be filed smooth. The surfaces to be jointed shall be wiped clean, etched and the primer applied. With primer still wet, apply the approved cement and install the saddle. The saddle shall be drawn down with stainless steel metal straps or other approved means.

#### **23.05.4 Ductile Iron or Cast Iron Mains**

Where cast iron tees have not been installed in the sewer main, the main shall be tapped by machine drilling a hole of a size which shall fit a saddle for the service line. The drilling machine and method of drilling and the saddle shall be approved by the Inspector. The saddle shall be sealed when attached to the main and held in place with metal straps or other approved means.

#### **23.05.5 Concrete Mains**

Concrete mains shall not be tapped for individual service laterals. A manhole according to these specifications shall be installed to provide sewer service with authorization of Aurora Water Engineering.

#### **23.05.6 Re-lined Mains**

Service connections to lined mains where a lining has been installed shall not protrude into the main if an "insert-a-tee" or approved equal is installed. Furthermore, the host pipe shall remain intact when a saddle tee is installed on the lined main.

#### **23.06 Clean Outs**

Clean outs shall be constructed according to these specifications. Clean outs shall be constructed so no surface load shall be transferred to the main, wye, 1/8 bend, or riser pipe. The area around a clean out shall be graded so water runs away from the clean out. Clean outs are required at a maximum interval of one hundred feet (100') or at changes in grade.

#### **23.07 Service Stub-In to Property Line**

Service stub-ins shall be extended at least to the property line and be plugged with a PVC compression stop. The end shall be pressure capped and marked at the surface with a four inch (4") x four inch (4") wood or steel "T" post. Sewer services may not be tapped from mains larger than twelve inches (12") in diameter without authorization from Aurora Water.

Exact locations of the service line taps from a manhole shall be noted during CCTV inspection by the Contractor as necessary.

#### **23.08 Sidewalk or Curb Crossing**

In no instance shall trenches extend beneath an existing sidewalk or curb. The pipe must be bored, jacked, or tunneled through the earth under the curb or sidewalk, or the sidewalk removed and replaced.

#### **23.09 Trench Backfilling**

Backfilling shall conform to these specifications and City of Aurora's Public Works' Roadway Specifications for areas within the public right of way. The City of Aurora Material Testing Laboratory personnel must approve the compaction test on the service trench within the street right-of-way prior to patching the street.



### **23.10 Inspection**

Inspectors will inspect all work from the sanitary sewer main to the building. This includes new services as well as service repairs. The Inspector has the authority to halt construction when, in their opinion, these specifications or proper construction practices are not being followed. Whenever any portion of these specifications is violated, the Inspector may order further construction to cease until all deficiencies are corrected. No pipe fittings or connections shall be covered until approved by the Inspector. Inspections can be scheduled by calling the Inspections Line at least one (1) business day before the time when inspection is needed, and after applicable fees are paid. Re-inspection fees may apply to work that does not comply with these specifications.

### **23.11 Maintenance of Traffic**

Interference with traffic shall be avoided at all times. Adequate barricades, signs and warning devices shall be placed and maintained until the site is restored to its original condition. Refer to the Public Works Roadway Design and Construction Specifications for further information.

### **23.12 Warranty of Work**

The owner/developer shall be responsible for any settlement or deterioration of the roadway and shall maintain the surface over trenches in approved condition throughout a year warranty period.

### **23.13 Discontinuation of Sewer Service**

Sanitary Sewer Services that are not utilized at the time of redevelopment must be abandoned at the point of connection to the public main.

Whenever a sewer service will be discontinued for a period longer than six (6) months, the service line shall be uncovered at the sewer main and the service connection removed and sealed with a watertight plug. An Inspector will inspect the disconnection prior backfilling the hole. [Backfilling shall conform to these specifications.] Should the sewer service be scheduled to be returned to service within six (6) months, instead of disconnection at the main, the service line shall be disconnected by removing a one foot (1') section of the service line directly inside the property line and the end sealed with a watertight plug. The Inspector will inspect the disconnection before backfilling. After backfilling a four inch (4") x four inch (4") wood or steel "T" post shall be set in the ground to mark the end of the service line. Aurora Water reserves the right to require disconnections of abandoned sanitary sewer taps at the main if the existing service or tap is in unsatisfactory condition. Existing service laterals which are damaged, leaking or in any other condition which may lead to future repair of the main shall be deemed unsatisfactory.

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## **SECTION 24.00 PRIVATE UNDERDRAIN PIPE**

- 24.01 General
- 24.02 PVC Pipe
- 24.03 HDPE Pipe
- 24.04 Bedding
- 24.05 Alignment
- 24.06 Underdrain Clean Outs
- 24.07 Underdrain Outfall Locations
- 24.08 Installation

## **SECTION 24.00 PRIVATE UNDERDRAIN PIPE**

### **24.01 General**

Underdrain pipe shall be Polyvinyl Chloride (PVC) or High Density Polyethylene (HDPE) and provided with joints which prevent any shifting or misalignment of the line, or joints which, in the opinion of the Engineer, will allow adequate infiltration or exfiltration. Main underdrain lines shall be no less than six inches (6") in diameter. Lateral underdrains must have a minimum diameter of four inches (4").

The City of Aurora will NOT be responsible to maintain or repair main underdrain lines or laterals that drain structure foundations to the underdrain system. Underdrains are not a part of the sanitary sewer system and they shall not connect to the system at any time. All underdrain installations shall be in accordance with the recommendations of a geotechnical engineer and the approved drawings. Approved underdrain systems shall remain private in perpetuity and maintained either by the owner, owner's association, or metropolitan district. The civil plans showing the underdrain system shall have a note added to the plans identifying who is responsible for the ownership and maintenance of the underdrain system. See Sections 2.03.6.15 and 2.03.6.21 in the [\*Roadway Design & Construction Specifications\*](#), latest edition. For portions of the underdrain system installed in a public right-of-way or City easement, a license agreement is required and City Water Engineering Inspections will only inspect the outfall location for acceptance. The License Agreement shall be executed through the Public Works Department, Real Property Division at 303-739-7300.

### **24.02 PVC Pipe**

All non-perforated PVC pipe shall conform to ASTM 3034-SDR 35. Perforated PVC shall have perforations located in the lower quadrant. PVC underdrain shall be wrapped per geotechnical engineers recommendations. The pipe shall be installed in full compliance with ASTM D2321. The system shall not be watertight.

### **24.03 HDPE Pipe**

All non-perforated pipe shall conform to AASHTO M252 Type 'S'. All perforated HDPE Pipe shall conform to AASHTO M252 Type 'SP'. Color of pipe shall be black. Material shall be resistant to ultraviolet rays. The system shall not be watertight.

### **24.04 Bedding**

Bedding for underdrain pipe in trenches shall meet the general requirements of Standard Detail #100 Class B Alternate Bedding for sanitary sewer. The trench should be lined with a geotextile fabric as recommended by the design engineer. The geotextile fabric shall be overlapped a minimum of twelve inches (12") and properly secured. In the event unstable trench conditions are encountered which will not support the pipe, the trench shall be further sub-excavated and backfilled with one and one half inches (1½") of uniformly graded washed rock to within six inches (6") of the underdrain pipe flow line and the remainder filled with granular bedding material. The underdrain pipe shall not be placed directly on top of the uniformly graded rock material. Crushed concrete is prohibited as a bedding material for underdrains.

## **24.05 Alignment**

The alignment of the underdrain pipe shall be parallel to the sanitary sewer, according to these specifications and details, not be located directly beneath any manholes, and at no time be unable to drain. See Standard Details 100-2 and 302-1 for additional information.

Design of underdrain systems for structure foundations are the responsibility of the owner/developer and all laterals that connect to the underdrain main located within City right-of-way shall be designed with a minimum slope of two percent (2%). Underdrain laterals are considered private and are not maintained by the City of Aurora.

## **24.06 Underdrain Clean Outs**

Clean outs for underdrain systems shall in no case be installed inside of a public storm or sanitary sewer manhole. Clean outs shall not be the responsibility of the City to maintain and shall be constructed in accordance with these specifications. Clean outs shall be constructed so no surface load will be transferred to the underdrain main, wye, bend, or riser pipe and shall be accessible at the surface via a street valve box rated for HS-20 traffic loadings. The valve box lid shall be marked "PRIVATE STORM". The wye shall be concrete encased. The design of the underdrain system should consider providing a separate private cleanout on laterals to assist owners in confirming their underdrain system is functioning properly.

## **24.07 Underdrain Outfall Locations**

Outfall locations are required to be shown on civil drawings and shall be subject to review and approval by the City of Aurora. Underdrains shall not be connected to the sanitary sewer collection system nor shall they discharge onto the surface or to any other location not approved by the City. Underdrains shall only discharge into approved discharge locations such as a storm drainage structure or drainage course. The underdrain connection shall be properly grouted into a storm sewer manhole or inlet. When emptying into a water course, the outlet shall be adequately armored to resist scour and erosion. The outlet shall be protected with an outlet structure or headwall in accordance with CDOT standard details. If an underdrain is to outfall into a water quality pond designed to be dry, then the outfall should be connected to the pond's outlet structure. The outlet of the underdrain system should be protected from small rodents entering the private system. Underdrain outfall locations shall be marked with a locator pole, surveyed by the responsible party and provided to the City.

## **24.08 Installation**

Underdrains are privately owned and maintained as stated in Section 24.01. The City is not responsible for the installation or inspection of underdrain systems. The responsibility by the City shall be limited to verification of the discharge point into the public storm drainage system or drainage course per the approved drawings. Required compaction associated with the installation within public right-of-way shall adhere to the City's standards and specifications. Passing compaction results shall be submitted to the City prior to allowance of roadway paving to occur.

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## **SECTION 25.00 STORM SEWER PIPE INSTALLATION**

- 25.01 General
- 25.02 Approved Pipe Materials
- 25.03 Pipe Size
- 25.04 Excavation
- 25.05 Bedding
- 25.06 Installation
- 25.07 Backfill and Compaction

## **SECTION 25.00 STORM SEWER PIPE INSTALLATION**

### **25.01 General**

Designers shall use Sections 26.00 to 30.00 to select pipe materials to be used for storm sewer within the City of Aurora. These specifications were prepared in accordance with the Mile High Flood District, "Storm Sewer Pipe Material Technical Memorandum 3<sup>rd</sup> Edition", dated July 13, 2010, referred to as the "Report". When, in the opinion of the Engineer, the proposed pipe material for any installation does not conform to the recommendations of the Report, the City shall reserve the right to require a specific pipe material and bedding class. Only those pipeline materials described in the following sections shall be approved for storm sewer installations. All pipe materials to be incorporated in the construction of storm sewers shall conform to the requirements specified herein or as modified elsewhere in these specifications.

Resistivity measurements shall be performed according to Section 20.01 of these specifications.

**All PVC storm pipe shall be installed with an electronic marker system for locating purposes per section 14.07.3 of these specifications. Tracing wire is optional for private infrastructure only. Spigot shall not be inserted in the bell past the home line indicated on the spigot or the installation shall be rejected. Joint deflection on PVC pipe is not allowed without the approval of Aurora Water Engineering and shall not exceed manufacturer's recommendation.**

### **25.02 Approved Pipe Materials**

The following storm sewer pipe materials are approved for use in private or public Storm Sewer Systems within the City of Aurora:

- Reinforced Concrete Pipe (RCP)
- Reinforced Concrete Box Culvert Pipe (RCBC)
- Aluminized Steel Type 2 Pipe (ASP) (for private systems only)
- Polyvinyl Chloride Pipe (PVC)
- High Density Polyethylene Pipe (HDPE)
- Profile Wall Pipe (PE, HDPE, and PVC)
- Polypropylene (PP) (Public use as allowed by Aurora Water Engineering)

Pipe material selection charts are provided in subsequent sections for each pipe material. These charts present conditions the designer should follow in the selection of an appropriate pipe material. The report shall be referenced for specific standards if the conditions vary from what is presented in the charts.

RCP is required for storm sewers placed in arterial roadways within the City of Aurora. Right-of-Way shall be reinforced concrete pipe, Class III or higher. Other alternate pipe materials shall not be considered for use in arterial roadways.

Ductile Iron Pipe (DIP) maybe used in private systems where traffic loading conditions



dictate.

### **25.03 Pipe Size**

Storm sewer pipe to be maintained by City of Aurora shall be sized accordingly as shown on the project drawings but shall in no case be less than eighteen inches (18") in diameter. Arched and elliptical pipe shall only be allowed when conditions prevent the use of circular pipe. Profile wall pipe shall only be allowed in diameters eighteen inches (18") and larger.

### **25.04 Excavation**

Excavation of the pipe shall conform to Section 8.00 of these specifications.

### **25.05 Bedding**

Storm sewer pipe placed within the City of Aurora shall be bedded according to Section 9.00 of these specifications. Specific bedding classes for each installation shall be provided on the civil construction plans.

No less than Class B Alternative Compacted Granular Bedding Class shall be used for ASP, PVC and HDPE storm sewer. Bedding class for RCP storm sewer installation shall be specified on the project drawings.

### **25.06 Installation**

The Contractor shall use equipment, methods and materials which will ensure the pipe is installed according to the approved project drawings. Alignment and grade shall be kept to within  $\pm 1$  inch per one hundred feet (100') of the line and grade as indicated on the drawings.

Pipe shall not be placed on blocks unless the pipe will be encased in concrete.

Horizontal and vertical alignment deflection shall be accomplished at manholes only. Curvilinear storm sewer lines shall not be allowed. The Contractor shall begin placement of pipelines at the downstream end and proceed laying pipe with the spigot or tongue ends in direction of flow.

Every reasonable effort shall be made by the Contractor to preclude foreign material from entering the pipeline during and after installation. This shall be accomplished with snug-fitting closures placed at the end of each working day and appropriate "Best Management Practices" to protect the newly installed storm system from sediment deposits as necessary. The Contractor shall remove dirt or debris from the pipeline prior to additional pipe installation or final acceptance by the City.

**All STORM pipe shall be installed with an electronic marker system for locating purposes per section 14.07.3 of these specifications. Tracing wire is not allowed on public infrastructure. Spigot shall not be inserted in the bell past the home line indicated on the spigot or the installation shall be rejected.**

## **25.07 Backfill and Compaction**

Backfill shall be defined as the area above the pipe bedding section. The trench shall be backfilled and compacted according to Section 9.00 of these specifications.

After backfill and compaction of the trench is completed, the Contractor shall schedule an inspection and submit a closed circuit TV inspection of the main to Aurora Water of the completed pipeline and appurtenances for Initial Acceptance. See Section 21.07.4 for more information on the CCTV process. The Contractor will be notified of any deficiencies and shall be required to correct the deficient items prior to Initial Acceptance.

Deflection testing may be required as directed by the Inspector. Flexible pipe forty-eight inch (48") diameter or less shall be tested with a "Go/No-Go" deflection test gage, which shall be pulled through the pipe. The horizontal diameter shall not differ from the design diameter by more than five percent (5%). Pipe exceeding the maximum allowable deflection shall be removed and replaced by the Contractor. The equipment and labor for deflection test procedures shall be supplied by the installation Contractor.

Additional testing in accordance with Section 21.07 may be required by the Inspector or Engineer.

All required testing, inspection, and CCTV records shall be performed and submitted prior to the issuance of a paving permit. Furthermore, compaction tests shall be submitted to the City of Aurora Materials Testing Laboratory for review and approval prior to the issuance of a paving permit.

## **SECTION 26.00 REINFORCED CONCRETE (RCP) STORM SEWER PIPE**

- 26.01 General
- 26.02 Cement
- 26.03 Fitting and Specials
- 26.04 Lifting Holes
- 26.05 Acceptance of Pipe for Construction
- 26.06 Marking
- 26.07 Joints
- 26.08 Pipe Selection Chart

## **SECTION 26.00 REINFORCED CONCRETE (RCP) STORM SEWER PIPE**

### **26.01 General**

Only those pipeline materials described in this section will be approved for storm sewer installations. All pipe materials to be incorporated in the construction of storm sewers will conform to the requirements specified herein or as modified elsewhere in these specifications. All concrete pipe shall meet the requirements of AASHTO M170, AASHTO M242, ASTM C76, ASTM C655 or ASTM C361. Infiltration will be limited to two hundred (200) gallons per inch of diameter per mile per day when rubber gasket joints are required. Aurora Water reserves the right to require RCP in City of Aurora right of way. Storm Sewer pipe placed within City of Aurora arterial roadways shall be RCP Class III or higher. RCBC is allowed only on a case-by-case basis with prior approval from the City.

**All storm pipe shall be installed with an electronic marker system for locating purposes per section 14.07.3 of these specifications. Tracing wire is not allowed on public infrastructure.**

### **26.02 Cement**

Unless otherwise required by the Engineer, Type II Portland Cement complying with the requirements of ASTM Designation C150 will be acceptable in the manufacture of concrete pipe.

### **26.03 Fitting and Specials**

Details of all fittings and specials will be submitted to the Engineer for approval. Fittings and specials will be made up of pipe segments having the same structural qualities as the adjoining pipe and will be as shown on the drawings. Laying diagrams will be approved by the Engineer before construction.

### **26.04 Lifting Holes**

Lifting holes will be allowed and will be grouted closed before final inspection and initial acceptance of completed pipeline. Holes will be placed at the top of the pipe. Only two (2) lifting holes will be allowed per pipe segment.

### **26.05 Acceptance of Pipe for Construction**

In addition to deficiencies covered by the applicable ASTM Specifications, concrete pipe having any of the following visual defects will not be accepted:

- Porous areas on either the inside or the outside surface of a pipe section.
- Pipe patched or repaired.
- Exposure of the reinforcement.
- Pipe damaged during shipment or construction.

The Contractor will have full responsibility for any defects in material or workmanship of the completed pipeline.

## **26.06 Marking**

The following will be clearly marked on the interior of the pipe wall:

- ASTM Specification
- Class and size
- Date of manufacture
- Name or Trade-Mark of Manufacturer

## **26.07 Joints**

The joint design for concrete pipe shall be bell and spigot or tongue and groove. Where rubber gaskets are required or specified, the bell or tongue shall be of confined gasket or single offset spigot configuration. The joint assemblies shall be accurately formed so when each pipe section is forced together in the trench the assembled pipe shall form a continuous watertight conduit with smooth and uniform interior surface. If a gasketed joint is used, the gasket shall be the sole element of the joint providing water tightness

The jointing material used for concrete pipe storm sewer installations thirty-six inch (36") diameter and greater shall be a rubber gasketed joint. For storm sewers less than thirty-six inch (36") diameter the jointing material may be either a rubber gasket or a flexible plastic sealing compound, unless otherwise specified.

All joints and jointing material shall conform to the following minimum requirements.

### **26.07.1 Rubber Gasketed Joints**

Rubber gasket joints for tongue and groove or bell and spigot pipe using a confined gasket joint shall consist of an O-ring rubber gasket, or other approved gasket configuration, and shall conform to the requirements of the appropriate ASTM Specification of the pipe designated. Rubber gasket joints for tongue and groove or bell and spigot pipe using a single offset joint shall consist of a circular or non-circular rubber gasket or other approved gasket configuration and shall conform to the requirements of the appropriate ASTM Specification of the pipe. Gaskets may be either natural rubber or neoprene conforming to ASTM C443.

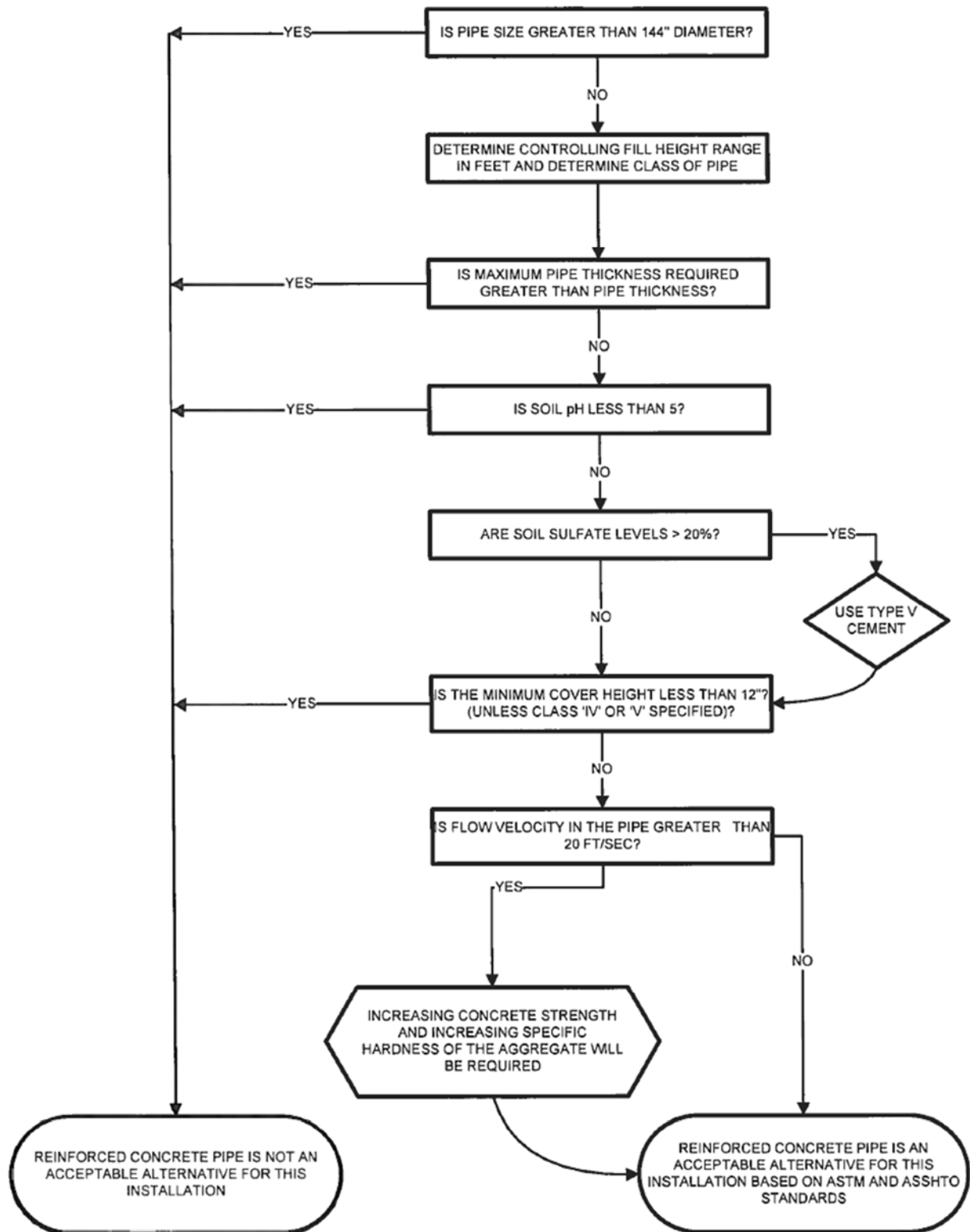
### **26.07.2 Flexible Plastic Joint Sealing Compound**

Preformed plastic gaskets conforming to the minimum requirements set forth above may be used as a joint sealant for storm sewer installations in lieu of rubber gaskets providing the flexible plastic gasket is in conformance with ASTM C990 and the plastic sealing compound is packaged in extruded preformed rope-like shape of proper size to completely fill the joint when fully compressed. The material shall be protected in a suitable, removable, two (2) piece wrapper so no wrapper may be removed as the compound is applied to the joint surface without disturbing the other wrapper, which remains attached to the compound for protection. The sealing compound shall be impermeable to water, have immediate bonding strength to the primed concrete surface and shall maintain permanent plasticity, and resistance to water, acids, and alkalis.

**26.07.3 Mortared Joints**

Mortared joints shall only be used in special circumstances and only where specifically authorized by the Engineer.

## 26.08. Pipe Selection Chart



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## **SECTION 27.00 ALUMINIZED STEEL (ASP) STORM SEWER PIPE**

- 27.01 General
- 27.02 Wall Thickness and Gage
- 27.03 Pipe Seams and Ends
- 27.04 Fittings and Specials
- 27.05 Protective Coatings
- 27.06 Coupling Bands
- 27.07 Pipe Selection Chart

## **SECTION 27.00 ALUMINIZED STEEL (ASP) STORM SEWER PIPE**

### **27.01 General**

Only those pipeline materials described in this section shall be approved for storm sewer installations. ASP Pipe can only be used on a case-by-case basis in private storm sewer systems with City review and approval.

Except as modified herein, all materials, manufacturing operations, testing, inspection and marking of spiral-ribbed, Aluminized Steel Type 2 pipe and pipe arch shall conform to the requirements of AASHTO M36, M274 and ASTM A760, A796, A798 latest revisions.

**All storm pipe shall be installed with an electronic marker system for locating purposes. Tracer wire is optional for private storm infrastructure.**

### **27.02 Wall Thickness and Gage**

Minimum thicknesses and fill heights for spiral-ribbed, ASP shall be as follows:

Pipe Size (Inches)	Thickness (Ga.)	Minimum Cover (Feet)
18-48	.064" (16 ga.)	1.0
54-60	.079" (14 ga.)	1.5
66-72	.109" (12 ga.)	1.5
Over 72	Design	2.0

### **27.03 Pipe Seams and Ends**

Pipe ends shall be fabricated with helical corrugations having a continuous lock seam extending from end to end of each length of pipe. Each end of each length of pipe shall be re-rolled to a minimum of three (3) annular corrugations.

### **27.04 Fittings and Specials**

Details of all fittings and specials shall be according to ASTM 998 or as shown on the approved project drawings. Fittings and specials shall be made of the same material and shall have the same structural qualities as the adjoining pipe. Under no conditions shall the wall thickness be less than the adjoining pipe.

All factory made tees shall be subject to City review prior to acceptance on a case-by-case basis. Such tees are prohibited where they may be subject to wheel loads.

### **27.05 Protective Coatings**

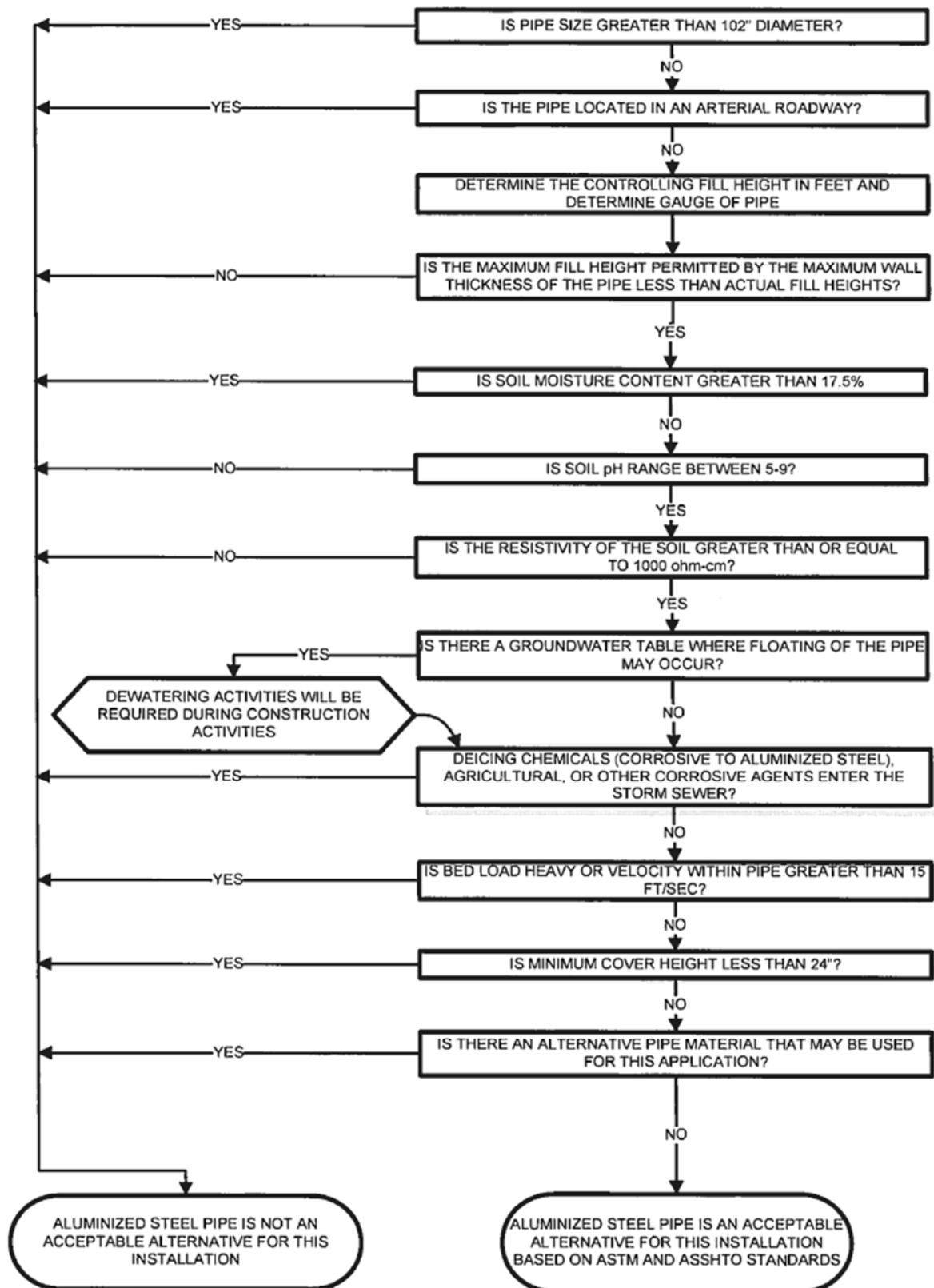
All metal sheets for pipe shall be formed from Aluminum Steel Type 2 sheet conforming to AASHTO M274.

## **27.06 Coupling Bands**

Aluminized Type 2 steel pipe used within the City of Aurora shall utilize coupling bands manufactured according to AASHTO M36. Coupling bands shall be no less than ten and one half inches (10½") wide and shall be made from aluminized steel of the same thickness as the pipe.

Coupling bands shall incorporate the use of O-ring gaskets meeting or exceeding the requirements of AASHTO M198 and shall be placed on both sides of the joint. Each coupling band is required to have bar, bolt, and strap connector assemblies per lap. Hardware for coupling bands shall conform to AASHTO M36.

## 27.07 Pipe Selection Chart



## **SECTION 28.00 POLYVINYL CHLORIDE (PVC) STORM SEWER PIPE**

28.01 General

28.02 Pipe and Fittings

28.03 Joints

28.04 Fittings and Specials

28.05 Pipe Selection Chart

## **SECTION 28.00 POLYVINYL CHLORIDE (PVC) STORM SEWER PIPE**

### **28.01 General**

Only those pipeline materials described in this section will be approved for storm sewer installations. All pipe materials to be incorporated in the construction of storm sewers shall conform to the requirements specified herein or as modified elsewhere in these specifications. Except as modified herein, all materials, manufacturing operations, testing, inspection and marking of polyvinyl chloride (PVC) conform to the requirements of ASTM D2321, ASTM 3212, ASTM 477, ASTM F679 or ASTM F794 latest revision.

Minimum cover of the pipe shall be two feet (2'), or one (1) pipe diameter (whichever is less), as determined by ASTM D2321.

**All PVC storm pipe shall be installed with an electronic marker system for locating purposes. Tracing wire is not allowed on public infrastructure. Spigot shall not be inserted in the bell past the home line indicated on the spigot or the installation shall be rejected. Joint deflection on PVC pipe is not allowed without the approval of Aurora Water Engineering and shall not exceed manufacturer's recommendation.**

**This material is not approved for use within arterial roadways.**

### **28.02 Pipe and Fittings**

Storm sewer pipe to be maintained by City of Aurora shall be sized accordingly as shown on the project drawings but shall in no case be less than eighteen inches (18") in diameter. PVC plastic gravity sewer pipe and fittings shall conform to ASTM F679 or profile wall conforming to ASTM F794, with minimum pipe stiffness of forty-six (46) psi.

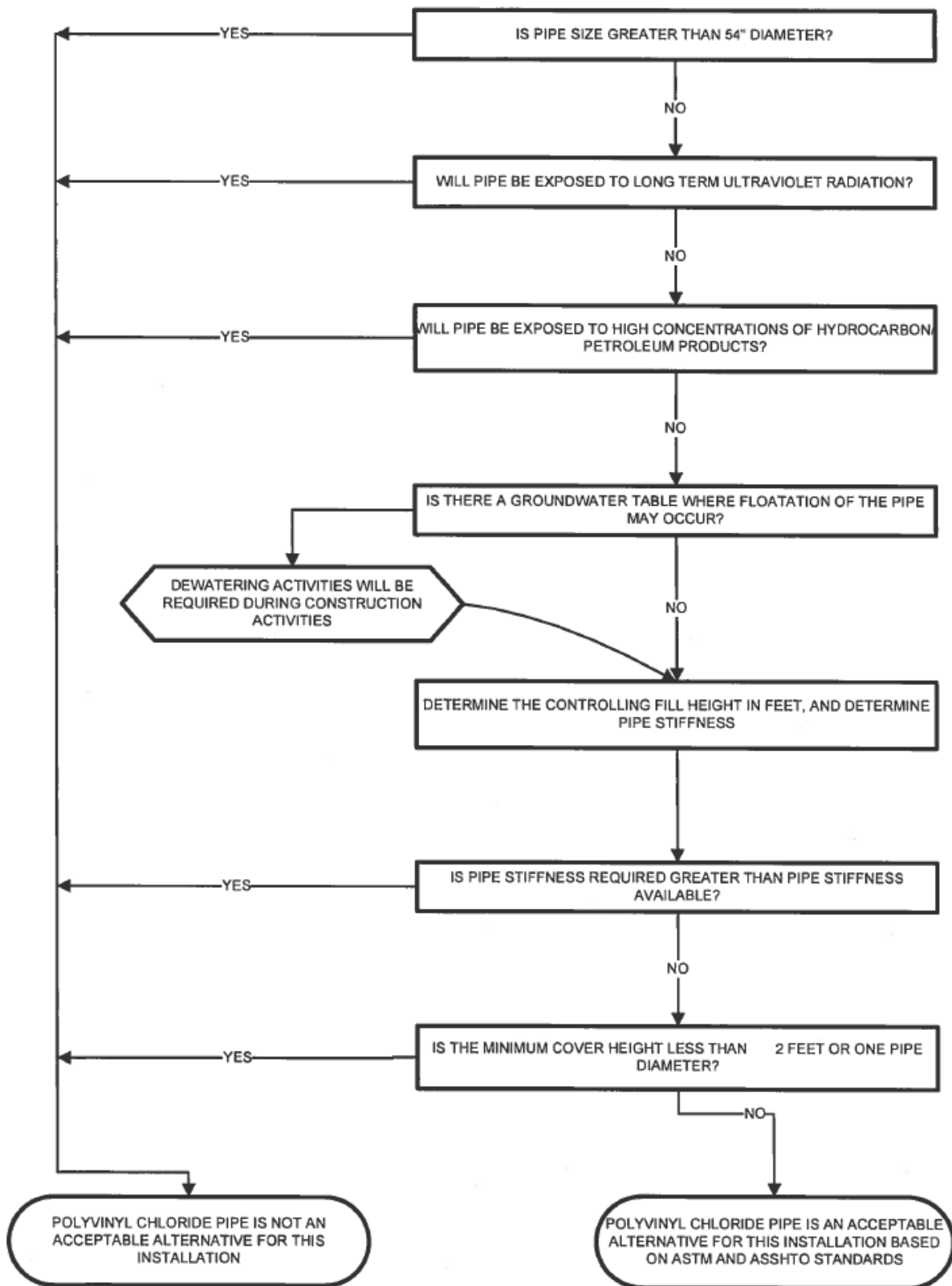
### **28.03 Joints**

Pipe joints shall be air-tight and of the bell spigot type with elastomeric gaskets conforming to the requirements of ASTM D3212.

### **28.04 Fittings and Specials**

Details of all fittings and specials shall be shown on the drawings for approval by the Engineer before construction. Fittings and specials shall be made of the same material and shall have the same structural qualities as the adjoining pipe. Under no conditions shall the wall thickness be less than the adjoining pipe.

## 28.05 Pipe Selection Chart



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## **SECTION 29.00 HIGH DENSITY POLYETHYLENE (HDPE) STORM SEWER PIPE**

- 29.01 General
- 29.02 Bedding Material
- 29.03 Pipe and Fittings
- 29.04 Diameter of Pipe
- 29.05 Joints
- 29.06 Pipe Selection Chart

## **SECTION 29.00 HIGH DENSITY POLYETHYLENE (HDPE) STORM SEWER PIPE**

### **29.01 General**

Materials and methods in this section may be employed in areas where the depth of cover (top of pipe to subgrade elevation) is two foot (2') minimum or one (1) pipe diameter (whichever is greater) but does not exceed ten feet (10') per AASHTO Section 18.

**All HDPE storm pipe shall be installed with an electronic marker system for locating purposes. Tracing wire is not allowed on public infrastructure. This material is not approved for use in arterial roadways.**

### **29.02 Bedding Material**

The bedding for all HDPE pipe shall be Class B Alternate Compacted Granular Bedding. Bedding material shall be hand placed under haunches of pipe to ensure uniform support.

### **29.03 Pipe and Fittings**

The pipe and fittings shall be homogenous throughout and free of visible cracks, holes, foreign inclusion, or other injurious defects. The pipe shall be uniform in color, opacity, density, and other physical properties.

HDPE pipe and fittings shall have smooth interior and annular exterior corrugations. Eighteen inch (18") through forty-eight inch (48") pipe shall meet the requirements of AASHTO M294 Type S. Virgin material for pipe and fitting production shall be high-density polyethylene conforming with the minimum requirements of cell classification 435400C for eighteen inch (18") through forty-eight inch (48") diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed four percent (4%).

Fittings shall conform to AASHTO M294. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of AASHTO M294.

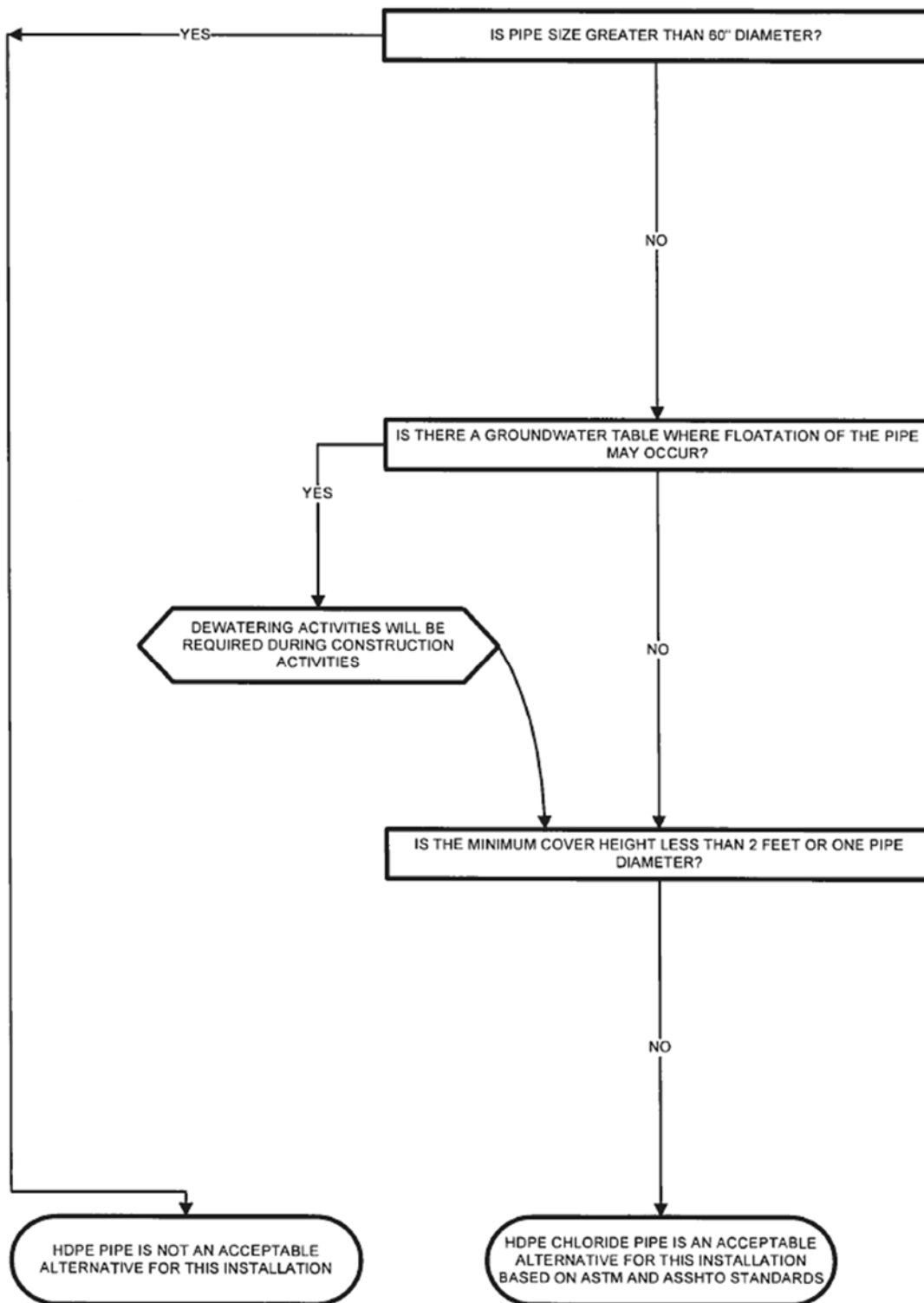
### **29.04 Diameter of Pipe**

The diameter indicated on the approved construction drawings shall mean the nominal inside diameter of the pipe. Nominal inside diameters shall be true to the specified pipe size  $\pm 1/4$  inch.

### **29.05 Joints**

Pipe shall be joined with a water tight joint meeting the requirements of AASHTO M294. Eighteen inch (18") through forty-eight inch (48") shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

## 29.06 Pipe Selection Chart



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## **SECTION 30.00 OPEN CHANNELS AND PONDS**

30.01 General

30.02 Access

30.03 Landscaping

30.04 Acceptance

## **SECTION 30.00 OPEN CHANNELS AND PONDS**

### **30.01 General**

Design and construction for open channels, ponds and hydraulic structures shall conform to City of Aurora Storm Drainage Design and Technical Criteria Manual, latest revision, and Mile High Flood District Urban Storm Drainage Criteria Manual Volumes 1, 2, and 3, latest revision. If there is a conflict between these two standards, the more restrictive standard shall apply. Inspectors will inspect all channels and ponds (public and private) for conformance to these standards.

Detention and water quality ponds certified by the consultant and accepted by the city may not be used for temporary sediment ponds during construction without appropriate modification. If an existing detention and water quality pond will be retrofitted for a sediment pond, then the pond shall need to be re-accepted and re-certified. Sediment pond requirements are outlined in the City of Aurora Rules and Regulations Regarding Stormwater Discharges Associated with Construction Activities, latest revision.

Pond outlets, wingwalls, headwalls and other drainage related facilities are required to have safety railing per Detail S18.1 of City of Aurora Roadway Design and Construction Specifications when there are vertical separations thirty inches (30") or greater thirty feet (30') or less from a designated roadway, trail, sidewalk, pedestrian access, in residential areas, schools, parks, or in specific cases as required by the City of Aurora. Refer to City of Aurora Roadway Design and Construction Specifications for railing requirements associated with retaining walls.

All obstructions are prohibited within the one hundred (100) year floodplain, including fences. Fences in drainage easements are prohibited unless prior approval has been obtained from the Water Department and license agreement has been obtained.

The following additional requirements apply to open channels and ponds maintained by Aurora Water.

### **30.02 Access**

#### **30.02.1 Open Channels**

Continuous all-weather vehicular maintenance access twelve feet (12') in width is required for the entire length of an open channel and be designed to support a Vac-Con (50,000lbs on three axles). Recycled asphalt and recycled concrete are prohibited for this application. Access may be combined with regional trails and/or sanitary sewer access roads at the discretion of Aurora Water. Additionally, access is required to the channel bottom both upstream and downstream of all grade control drop structures. Appropriate turnarounds shall be provided as required by Aurora Water Engineering. Maximum slope for maintenance only trails is ten percent (10%). Access Maximum slope for multi-purpose regional trails shall be at the discretion of City of Aurora Parks Recreation and Open Space Department.

### **30.02.2 Public and Private Basins**

Continuous all-weather vehicular maintenance access ten feet (10') in width is required to the bottom of the pond including the outlet structure and fore-bay. Crusher Fines are not allowed in a publicly maintained access road. Recycled asphalt is an acceptable alternative for this application. Access is also required to the top of the outlet structure at all times (i.e. when pond is full). If the outlet structure is not built into the pond bank, a catwalk extending from the nearest vehicular access to the outlet structure shall be required. Low flow channels shall be a minimum of six feet (6') in width.

### **30.03 Landscaping**

Permanent vegetative landscaping shall consist solely of non-irrigated native grasses. Seed mix shall conform to City of Aurora Rules and Regulations Regarding Storm water Discharges Associated with Construction Activities. Trees, shrubs, bushes, mulch, etc. are prohibited in any tract or easement to be maintained by Aurora Water. Any variances to this requirement must be specifically pre-approved by Aurora Water by submitting a landscaping plan directly to Aurora Water Engineering. Permanent irrigation systems are prohibited on any basin or open channel for which Aurora Water has surface maintenance responsibilities.

### **30.04 Acceptance**

#### **30.04.1 Initial Acceptance**

Channels, ponds and hydraulic structures for City ownership and maintenance are eligible for initial acceptance once all construction as outlined in the plans is complete. An initial acceptance walk through shall be required with representatives of Aurora Water Environmental Inspections, Aurora Water Engineering and Aurora Water Storm Drain. Additionally the walk through may include Aurora Parks, Recreation and Open Space, Aurora Public Works, and/or Mile High Flood District as necessary. A notice of discrepancies or notification of initial acceptance will be forwarded to the Contractor/developer within two (2) weeks of the initial walk through.

#### **30.04.2 Final Acceptance**

Hydraulic structures to be maintained by the City require a one (1) year warranty period before final acceptance. The one (1) year warranty period begins on the date of initial acceptance. Final acceptance for pond and channel vegetation will not be issued until vegetation has reached seventy percent (70%) of pre-construction vegetative density or the required vegetative density as approved in the SWMP has been achieved. Vegetative density shall be measured based on vegetation from the approved seed mix, weeds do not qualify as vegetation. The Storm Water Quality Discharge Permit is closed out at final acceptance, if applicable. City of Aurora will assume maintenance responsibility once final acceptance has been issued.

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## **SECTION 31.00 POLYPROPYLENE (PP) STORM SEWER PIPE**

- 31.01 General
- 31.02 Bedding Material
- 31.03 Pipe and Fittings
- 31.04 Diameter of Pipe
- 31.05 Joints
- 31.06 Pipe Selection Chart

## **SECTION 31.00 POLYPROPYLENE (PP) STORM SEWER PIPE**

### **31.01 General**

Materials and methods in this section may be employed in areas where the depth of cover (top of pipe to subgrade elevation) is two foot (2') minimum or one (1) pipe diameter (whichever is greater) but does not exceed ten feet (10') per AASHTO Section 18. Poly Propylene may be allowed for public use as directed by Aurora Water Engineering.

**All PP storm pipe shall be installed with an electronic marker system for locating purposes per section 14.07.3 of these specifications. Tracing wire is not allowed on public infrastructure.**

**This material is not approved for use in arterial roadways.**

### **31.02 Bedding Material**

The bedding for all PP pipe shall be Class B Alternate Compacted Granular Bedding. Bedding material shall be hand placed under haunches of pipe to ensure uniform support.

### **31.03 Pipe and Fittings**

The pipe and fittings shall be homogenous throughout and free of visible cracks, holes, foreign inclusion, or other injurious defects. The pipe shall be uniform in color, opacity, density, and other physical properties.

PP pipe and fittings shall have smooth interior and annular exterior corrugations. Eighteen inch (18") through sixty inch (60") pipe shall meet the requirements of ASTM F2736 and AASHTO M330 Type S. Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2736, Section 4 and AASHTO M330, Section 6.1 for the respective diameters. Twelve inch (12") through sixty inch (60") PP pipe shall have a minimum pipe stiffness of forty-six (46) psi when tested in accordance with ASTM F2412.

Fittings shall conform to ASTM F2736, ASTM F2764, and AASHTO M330, for the respective diameters. Bell & spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Bell & spigot fittings shall meet the watertight connection according to the requirements of ASTM D3212.

### **31.04 Diameter of Pipe**

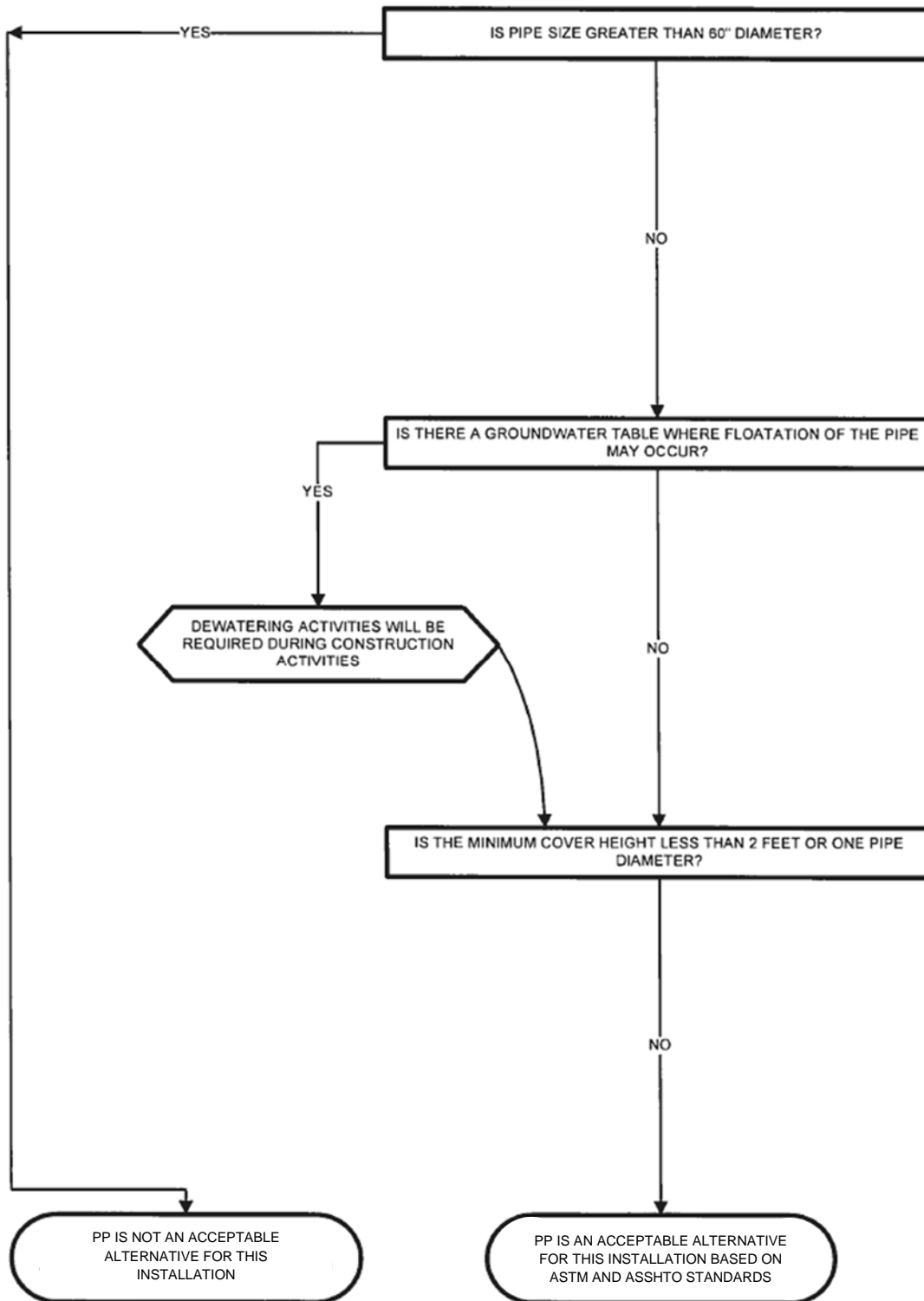
The diameter indicated on the approved construction drawings shall mean the nominal inside diameter of the pipe. Nominal inside diameters shall be true to the specified pipe size  $\pm 1/4$  inch.

### **31.05 Joints**

Pipe shall be joined with a gasketed integral bell and spigot joint meeting the requirements of ASTM F2736 or F2881, for the respective diameters. Spigots shall have gaskets meeting the requirements of ASTM F477. Gaskets shall be installed per the

manufacturer's recommendation and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

## 31.06 Pipe Selection Chart



# Appendix A



## Details

## Appendix A – Standard Details

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## LIST OF STANDARD DETAILS

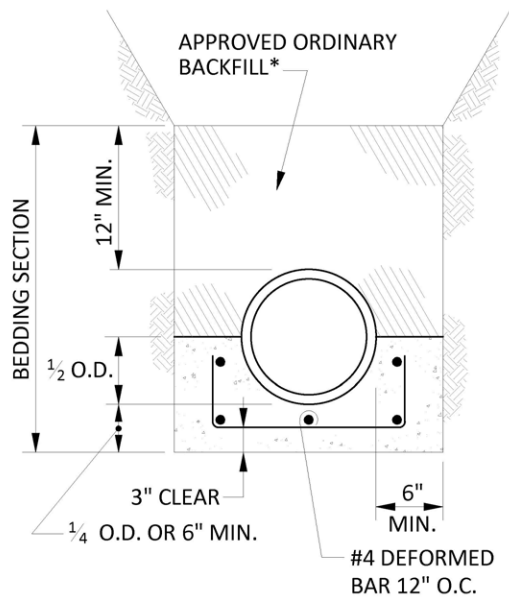
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## LIST OF STANDARD DETAILS

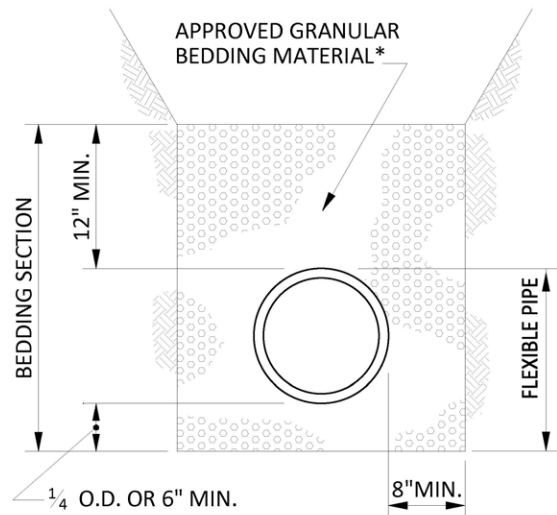
	<u>No. of Sheets</u>	<u>Page</u>
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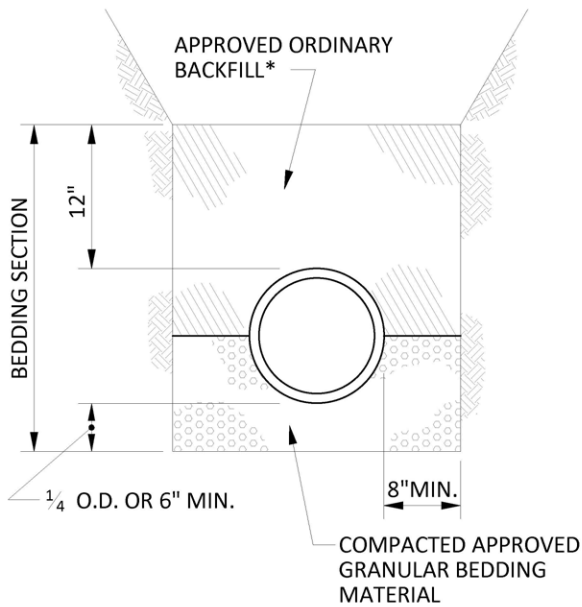
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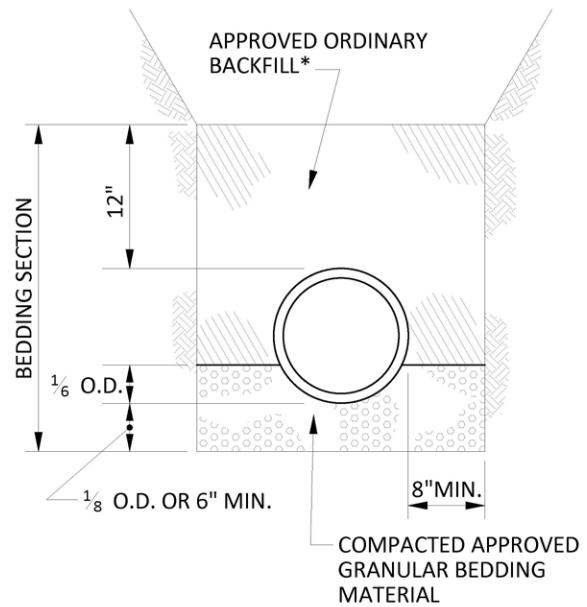
**CLASS A  
CONCRETE CRADLE**



**CLASS B  
ALTERNATE COMPACTED  
GRANULAR BEDDING**



**CLASS B  
COMPACTED GRANULAR BEDDING**



**CLASS C  
COMPACTED GRANULAR BEDDING**

NOTE: FOR WATER AND SANITARY SEWER PIPES THERE SHALL BE A MINIMUM OF 12" OF BACKFILL OVER THE PIPE BEFORE OTHER THAN HAND COMPACTION EQUIPMENT IS USED IN THE TRENCH.

\* SEE SECTION 9.04 FOR COMPACTION REQUIREMENTS



*David A. Reschke*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

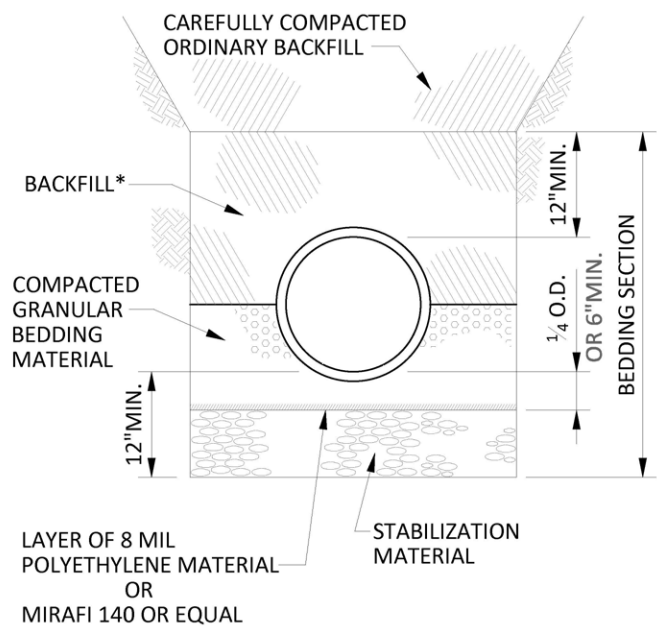
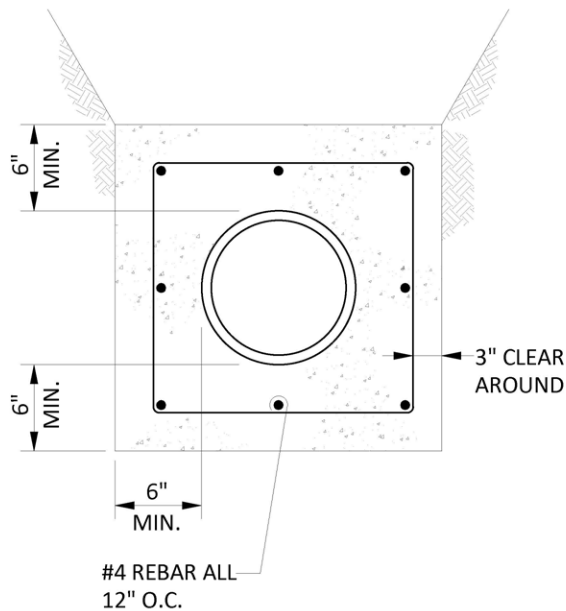
09/25/2019  
DATE  
09/23/2019  
DATE

## PIPE BEDDING CLASSES

1 of 2

100-1

## SANITARY SEWER WITH PRIVATE UNDERDRAIN



NOTE: FOR WATER AND SANITARY SEWER PIPES THERE SHALL BE A MINIMUM OF 12" OF BACKFILL OVER THE PIPE BEFORE OTHER THAN HAND COMPACTION EQUIPMENT IS USED IN THE TRENCH.

\* SEE SECTION 9.04 FOR COMPACTION REQUIREMENTS



*David A. Reckels*  
CITY ENGINEER  
*Vernon A. Adams*  
AURORA WATER

09/25/2019  
DATE

09/23/2019  
DATE

## PIPE BEDDING CLASSES

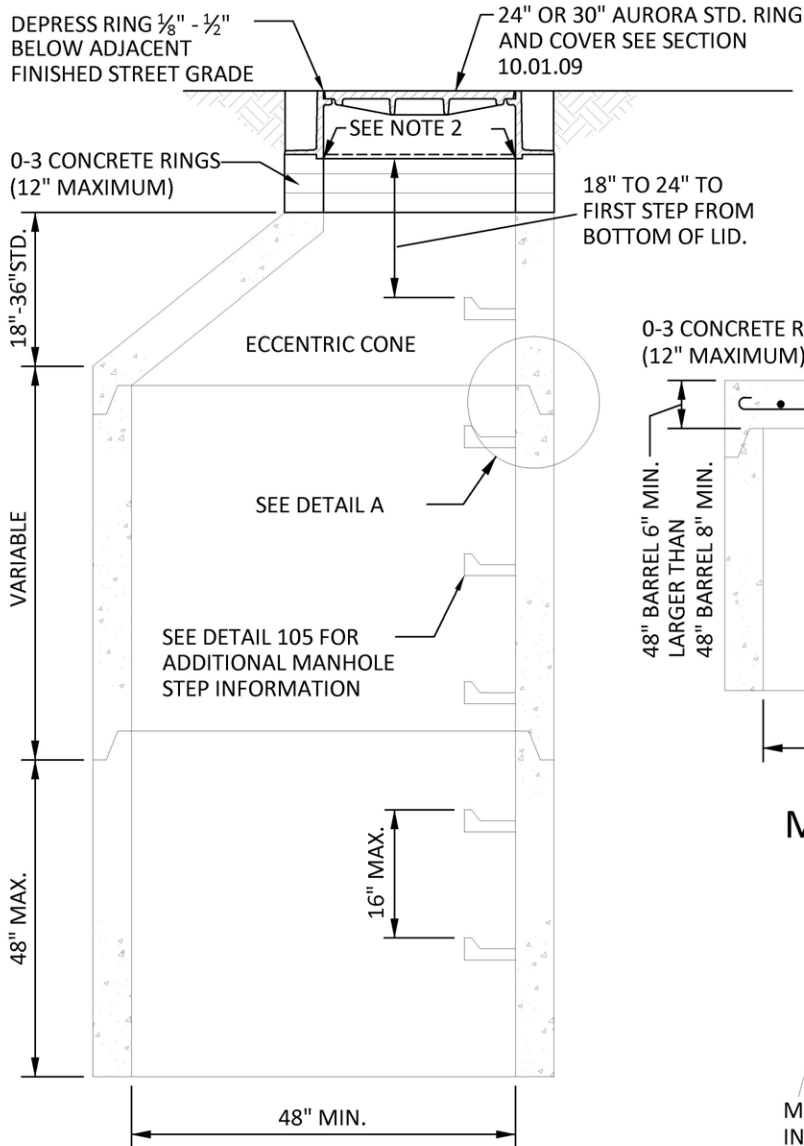
2 of 2

100-2

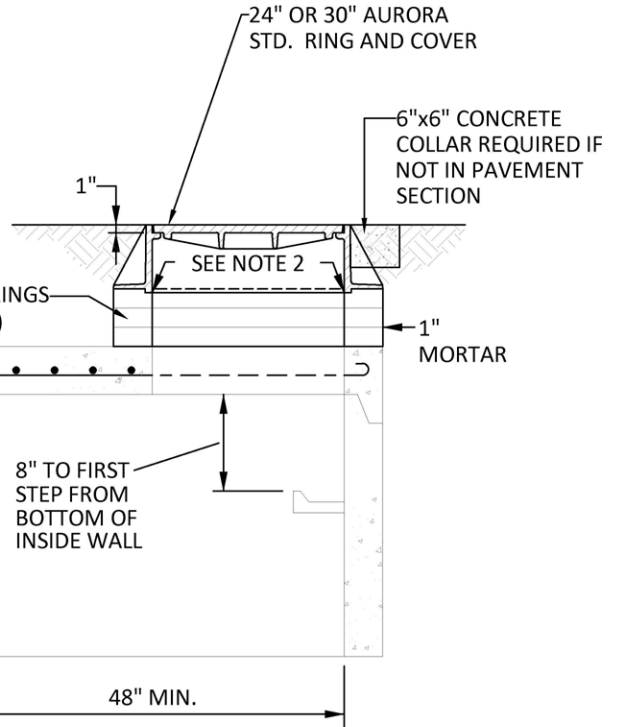
N:\PWD\PWD\DRAW\STANDARD\UTIL-STD\2019 REVISION\100-2.DWG

# STANDARD

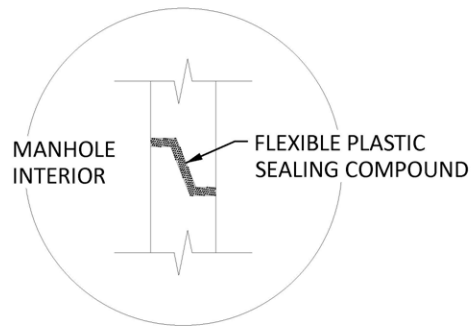
## PRECAST MANHOLES ASTM C478



## MANHOLE SECTION WITH ECCENTRIC CONE TOP



## MANHOLE SECTION WITH FLAT TOP (DEPTH LESS THAN 6.5 FEET)



### DETAIL A

### NOTES

1. FLEXIBLE PLASTIC SEALING COMPOUND BETWEEN RING AND CONE OR FLAT LID, OR CONCRETE RING.
2. MINIMUM OF 3 INCHES CLEARANCE BETWEEN ANY PIPE PENETRATION AND THE ECCENTRIC CONE SECTION OR FLAT LID.
3. SEE SECTION 10.01.09 FOR FRAME AND COVER SIZING
4. DEPRESS RING  $\frac{1}{8}$ " TO  $\frac{1}{2}$ " BELOW ADJACENT FINISH STREET GRADE.



AURORA  
WATER

*David A. Reckh*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

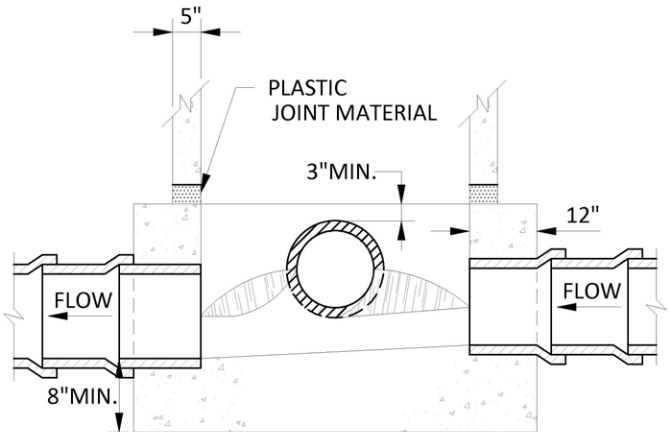
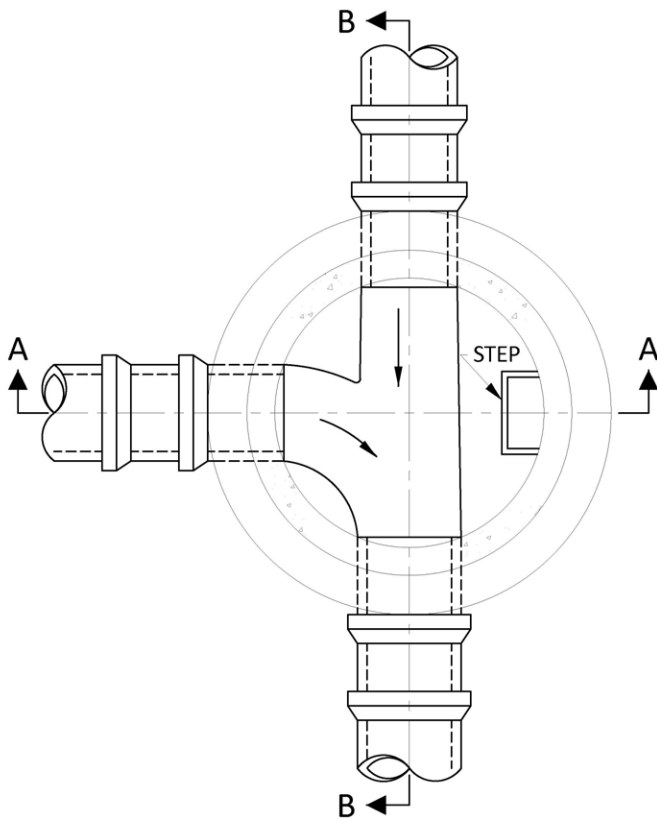
09/23/2019  
DATE

## STANDARD MANHOLES

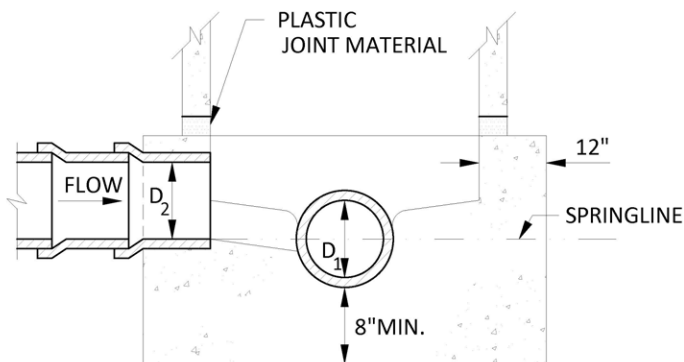
1 of 5

101-1

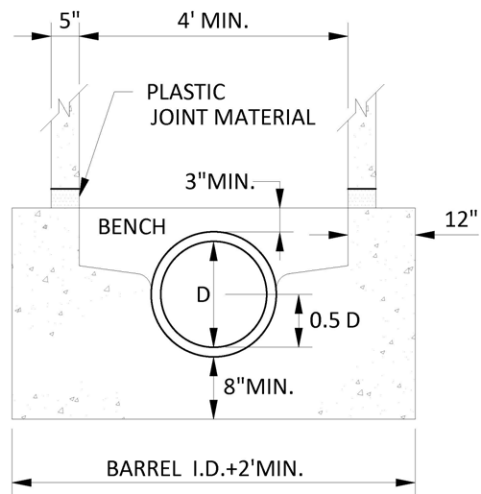
# STANDARD



SECTION B-B



SECTION A-A



MONOLITHIC BASE

## NOTES:

1. STRAIGHT PIPE SECTIONS MAY BE LAID THROUGH THE MANHOLE WITH CROWN REMOVED.
2. UNIFORM PIPE SIZE SECTION NOT LAID THROUGH THE MANHOLE SHALL DROP A MIN. OF 0.2 FEET.
3. BENCHES SHALL SLOPE 1 INCH/FT.
4. THERE SHALL BE A JOINT MADE AT THE EDGE OF MANHOLE BASE.

5. THE OUTSIDE WALLS SHALL BE FORMED TO THE DESIGNED SHAPE.
6. THE TOP OF THE BASE SHALL BE LEVEL IN ALL CASES.
7. PRECAST MANHOLE BASES SHALL HAVE A 6" COMPACTED LAYER OF  $\frac{3}{4}$ " COARSE AGGREGATE (#67).



*David A. Reilly*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

09/25/2019  
DATE  
09/23/2019  
DATE

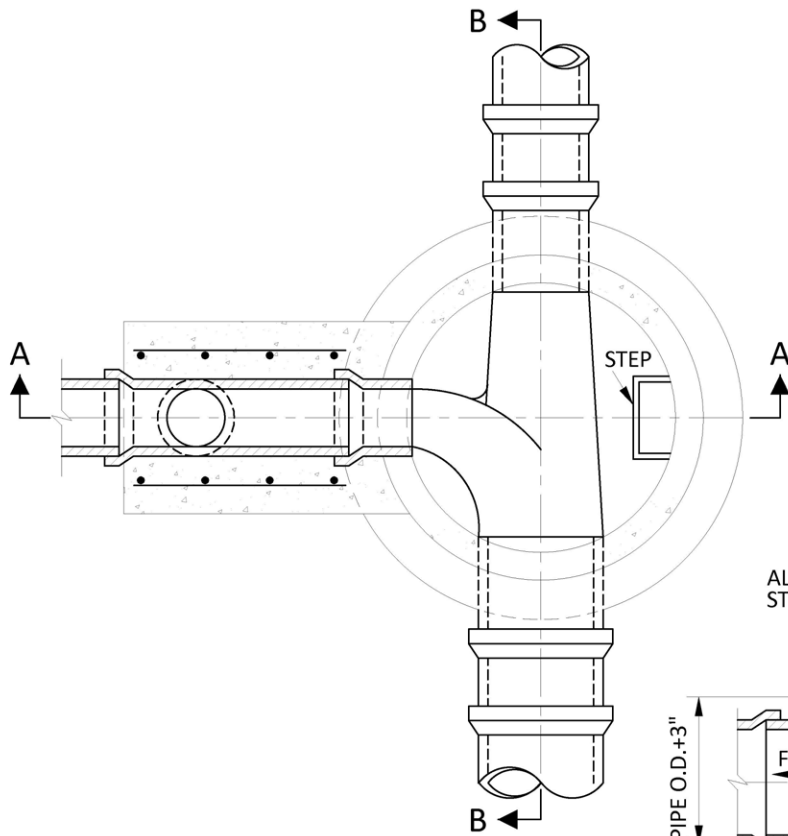
## MANHOLE BASE DETAIL

2 of 5

101-2

# STANDARD

DROP MANHOLE ALTERNATE  
POLYLINE DUCTILE IRON FITTINGS AND PIPE WITH  
MECHANICAL JOINTS MAY BE USED IN PLACE OF  
CONCRETE ENCASUREMENT.



ALUMINUM  
STEP

PLASTIC  
JOINT  
MATERIAL

PIPE O.D. + 3"

FLOW

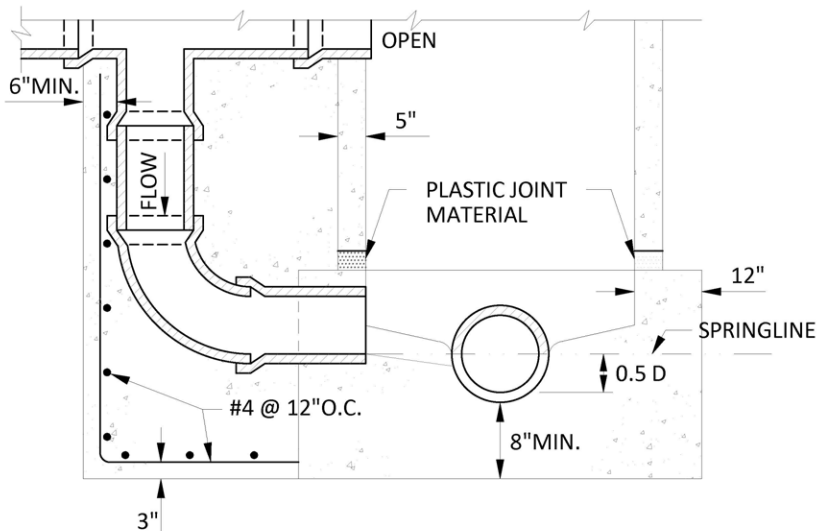
FLOW

FLOW

8" MIN.

BARREL I.D. + 2'

## SECTION B-B



## SECTION A-A

### NOTES:

1. STRAIGHT PIPE SECTIONS MAY BE LAID THROUGH THE MANHOLE WITH CROWN REMOVED WITH APPROVAL.
2. UNIFORM PIPE SIZE SECTION NOT LAID THROUGH THE MANHOLE SHALL DROP A MIN. OF 0.2 FEET, 0.3 FEET AT DEFLECTED MANHOLES.
3. BENCHES SHALL SLOPE 1 INCH/FT.
4. THERE SHALL BE A JOINT MADE AT THE EDGE OF MANHOLE BASE.
5. THE OUTSIDE WALLS SHALL BE FORMED TO THE DESIGNED SHAPE.
6. THE TOP OF THE BASE SHALL BE LEVEL IN ALL CASES.
7. ENCASUREMENT SHALL BE EXTENDED TO THE SPRINGLINE OF PIPE.
8. INSIDE DROP MANHOLES ARE NOT ALLOWED.



AURORA  
WATER

*David A. Schull*  
CITY ENGINEER

09/25/2019

DATE

*Vernon A. Adam*  
AURORA WATER

09/23/2019

DATE

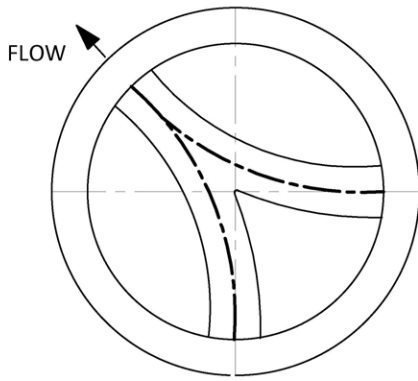
## DROP MANHOLE

3 of 5

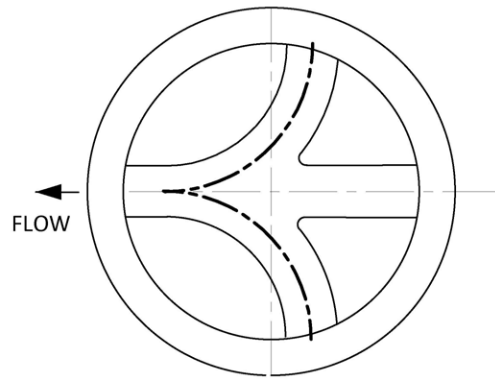
101-3



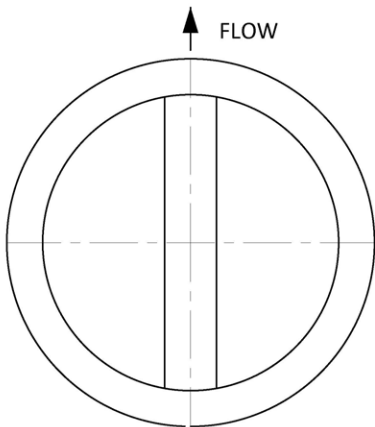
# STANDARD



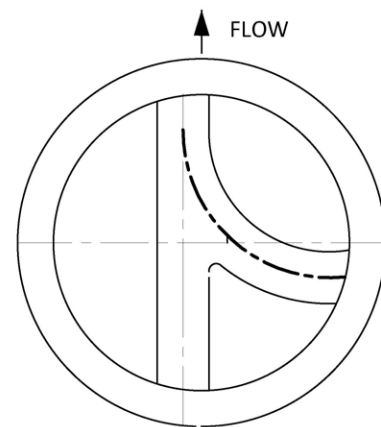
(Y) SWEEP



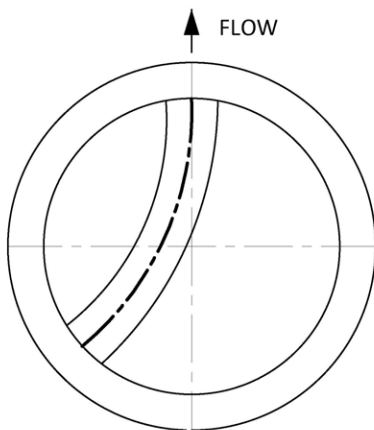
(T) SWEEP



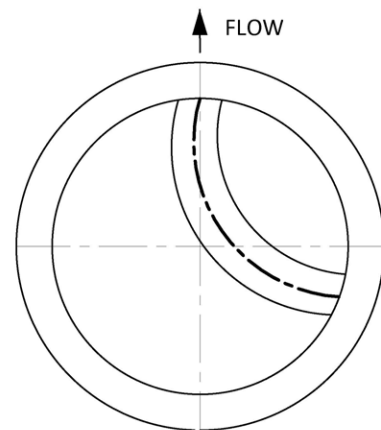
STRAIGHT



90 DEGREE (Y) SWEEP



VARIABLE SWEEP



90 DEGREE SWEEP

## NOTES

1. MAINTAIN PIPE CURVATURE THROUGHOUT THE CHANNEL.
2. APRON SHOULD BE SLIGHTLY SLOPED TO ALLOW FOR COMFORTABLE STANDING BY A WORKER.



AURORA  
WATER

*David A. Beckwith*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

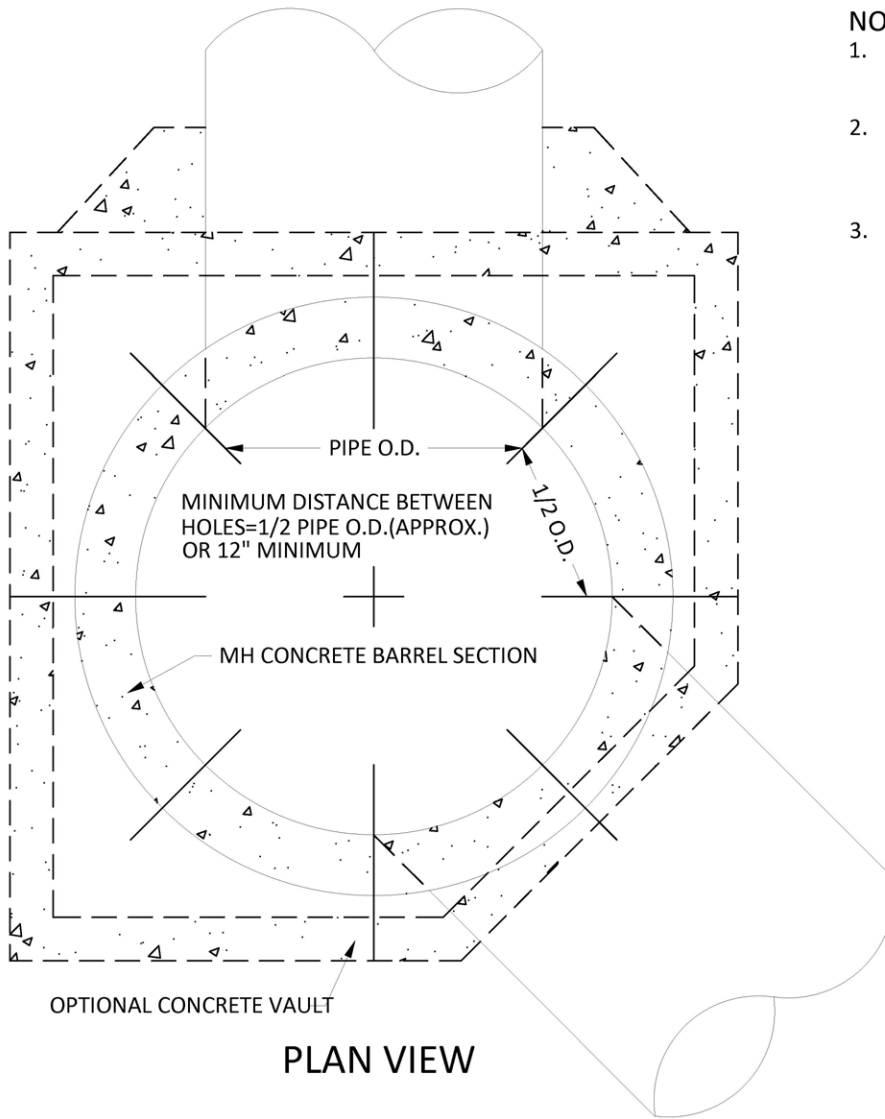
09/23/2019  
DATE

TYPICAL MANHOLE CHANNELS

4 of 5

101-4

# STANDARD



## NOTES:

1. THE ALIGNMENT OF PIPES INTO THE M.H. WILL DETERMINE THE BARREL SIZE FOR THE SIZE OF PIPE USED.
2. IF MINIMUM DISTANCES CANNOT BE OBTAINED DUE TO PIPE DIAMETERS, A SPECIAL CONCRETE VAULT SHALL BE USED IN PLACE OF A STANDARD M.H.
3. MANHOLES LARGER THAN 72" WILL BE ALLOWED WITH SPECIAL WRITTEN PERMISSION OF THE ENGINEER.

THE INTERNAL DIAMETER OF THE M.H. BARREL SHALL BE:

SANITARY SEWER		STORM SEWER	
PIPE SIZE	BARREL SIZE	PIPE SIZE	BARREL SIZE
12" or LESS	48"	27" or LESS	60"
15" to 27"	60"		72"
30" to 48"	72"	30" to 48"	



*David A. Reilly*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

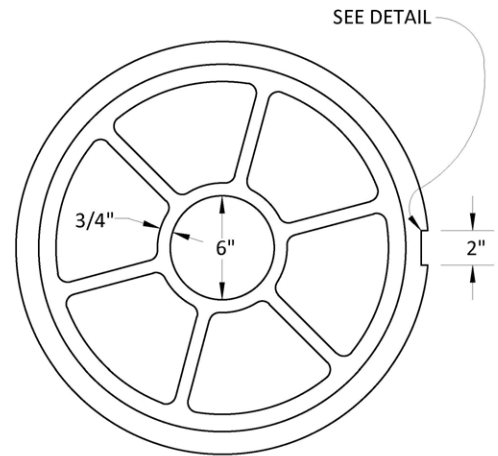
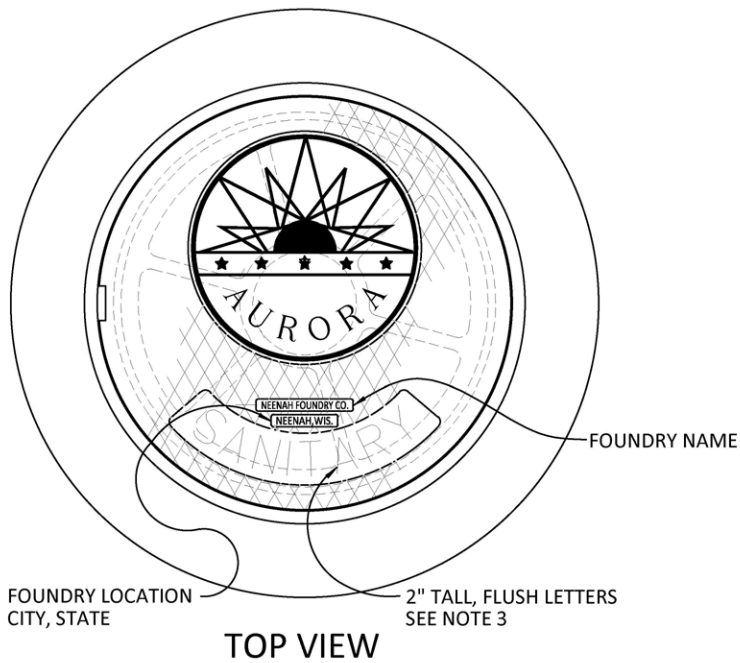
09/25/2019  
DATE  
09/23/2019  
DATE

MANHOLE BASE DETAIL

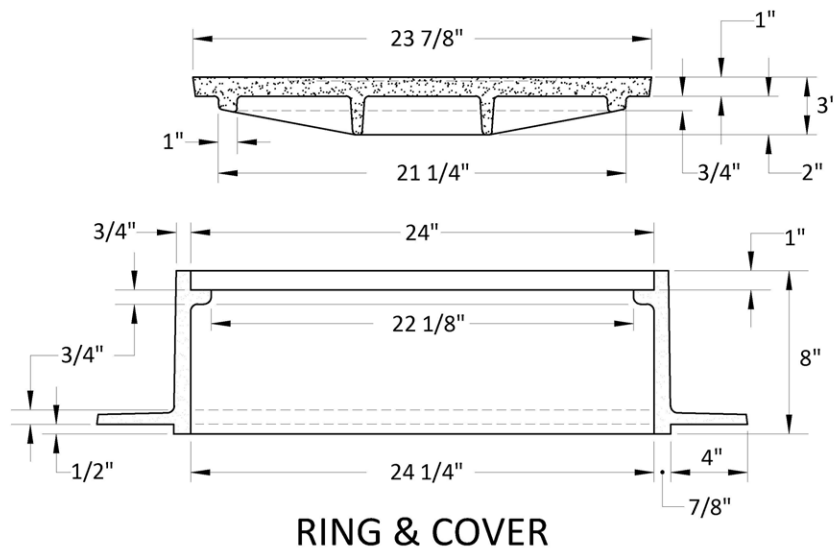
5 of 5

101-5

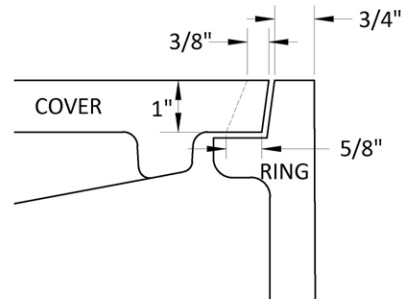
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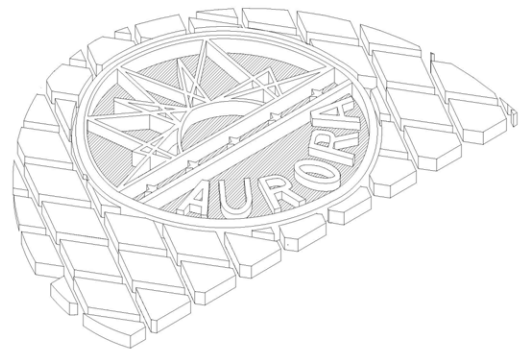
UNDERSIDE VIEW  
OF COVER



RING & COVER



DETAIL-LIFTING NOTCH



DETAIL-COVER DESIGN

TYPE "C" DESIGN: 1"X 1" SCORED 1/32"± DEEP

## NOTES:

1. A.S.T.M. DESIGNATION A-48-83 CLASS 25B (UNPAINTED).
2. ALL BEARING SURFACES TO BE MACHINED.
3. LETTERING ON COVER AS REQUIRED (WATER, SANITARY, OR STORM).
4. AURORA STANDARD-NEENAH R-1706, OR EQUAL, TOTAL MINIMUM WEIGHT APPROXIMATELY 224 LBS, MINIMUM FRAME WEIGHT -114 LBS, MINIMUM LID WEIGHT-110 LBS.
5. LIFTING NOTCH SHALL NOT EXTEND PAST INSIDE FACE OF RING SEAT.
6. SEE SECTION 10.00 FOR SPECIFICATIONS.
7. CITY OF AURORA LABELING IS NOT TO BE INCLUDED ON PRIVATE INFRASTRUCTURE.



AURORA  
WATER

*David A. Reiblich*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

09/25/2019  
DATE  
09/23/2019  
DATE

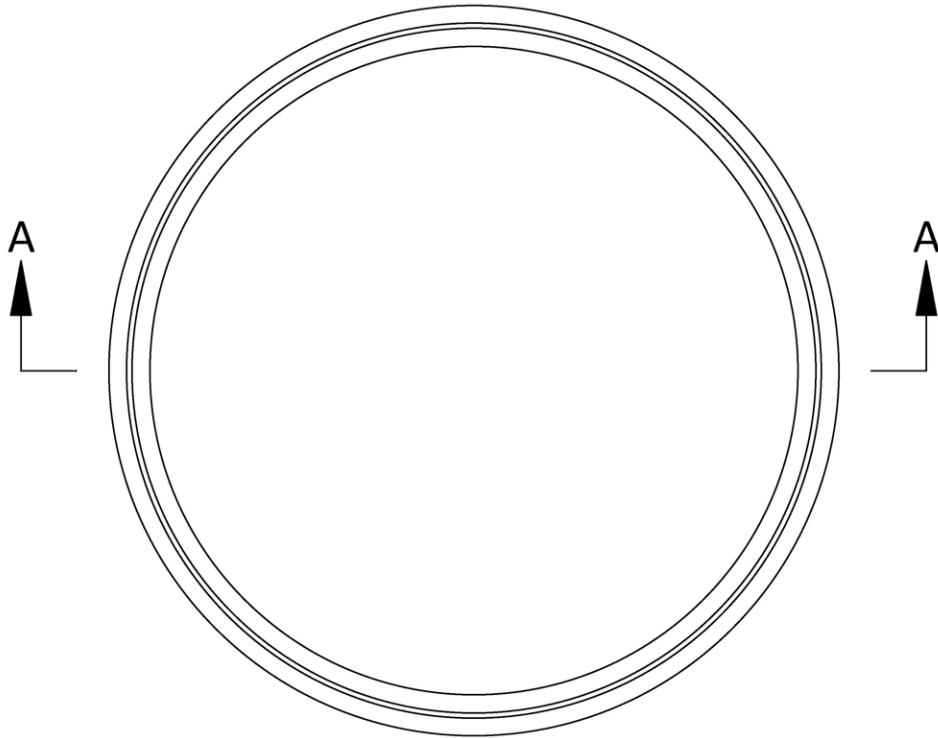
24" MANHOLE or  
INLET RING & COVER

1 of 3

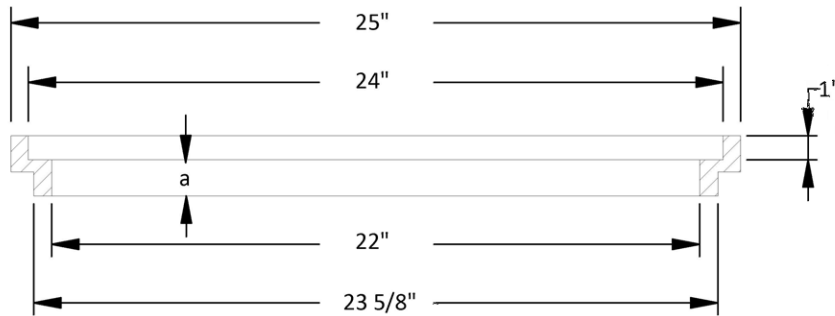
102-1



# STANDARD



PLAN



SECTION A-A



*David A. Rehder*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

09/25/2019  
DATE  
09/23/2019  
DATE

24" MANHOLE  
ADJUSTMENT RING

2 of 3  
102-2

# STANDARD

## NOTES

1. DIMENSION SHOWN IN **BOLD** SHALL HAVE A TOLERANCE OF  $\pm 1/16"$
2. DIMENSION **a** (RISER HEIGHT) =  $1 \frac{5}{16}"$ ,  $1 \frac{1}{2}"$ ,  $2"$ ,  $2 \frac{1}{2}"$ ,  $3"$  or  $4"$
3. ALL OTHER DIMENSIONS SHALL HAVE A TOLERANCE OF  $\pm 1/8"$
4. OUTSIDE DIMENSION OF  $23 \frac{3}{4}"$  ON LOWER SECTION OF RING SHALL BE MAINTAINED TO A MINIMUM OF  $1 \frac{1}{4}"$  FROM THE BOTTOM BEARING SURFACE OF THE RING

## SPECIFICATION FOR GRAY CAST IRON RISERS

1. CAST IRON RISERS SHALL CONFORM TO ASTM A48, CLASS 35B AND AASHTO M306
2. BEARING SURFACES BETWEEN MANHOLE RINGS AND COVERS AND FRAMES SHALL BE MACHINED TO PREVENT ROCKING
3. RISERS TO BE OF UNIFORM QUALITY FREE FROM SAND HOLES, GAS HOLES, SHRINKAGE, CRACKS OR OTHER DEFECTS
4. RISERS SHALL BE GROUND SMOOTH AND WELL CLEANED BY SHOT BLASTING
5. EACH RISER SHALL BE STAMPED WITH THE SIZE, NAME OF PRODUCING FOUNDRY, ASTM MATERIAL DESIGNATION, INDIVIDUAL PART NUMBER AND MANUFACTURE DATE

## SPECIFICATION FOR STEEL RISERS

1. STEEL RISERS TO BE MANUFACTURED WITH U.S. MILLED CARBON STEEL CONFORMING TO ASTM A36
2. PROVIDE CONTINUOUS FILLET OR GROOVE WELDS CONFORMING TO AWS D1.1 STRUCTURAL WELDING GUIDE
3. ALL WELDING SHALL BE PERFORMED BY CERTIFIED WELDERS
4. BEARING SURFACES BETWEEN MANHOLE RINGS AND COVERS AND FRAMES SHALL BE MACHINED TO PREVENT ROCKING
5. RISERS TO BE OF UNIFORM QUALITY FREE FROM SHRINKAGE, CRACKS OR OTHER DEFECTS
6. RISERS SHALL BE SMOOTH AND WELL CLEANED
7. EACH RISER SHALL BE STAMPED WITH THE SIZE, NAME OF PRODUCING MILL, ASTM MATERIAL DESIGNATION, INDIVIDUAL PART NUMBER AND MANUFACTURE DATE
8. SET SCREWS TO BE PROVIDED WITH RISERS



AURORA  
WATER

*Christopher R. Schell*  
CITY ENGINEER

09/25/2019

DATE

*Vernon A. Adam*  
AURORA WATER

09/23/2019

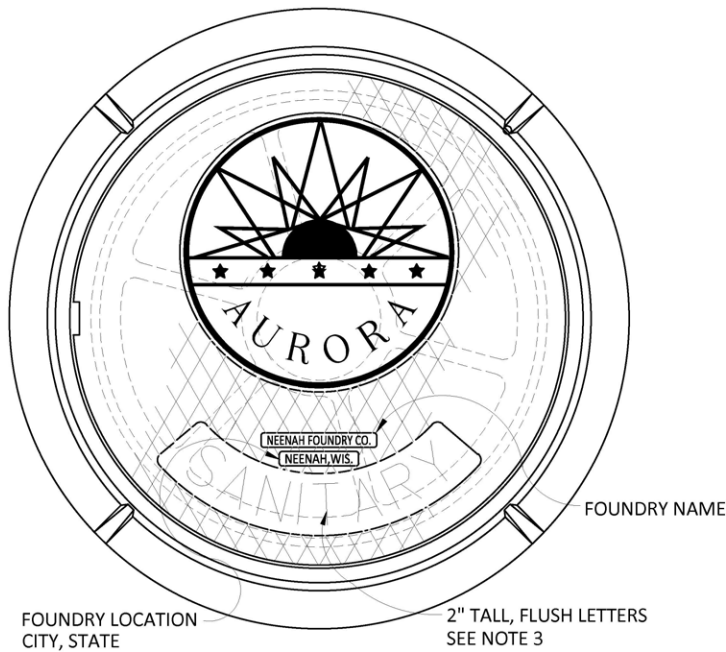
DATE

24" MANHOLE  
ADJUSTMENT RING

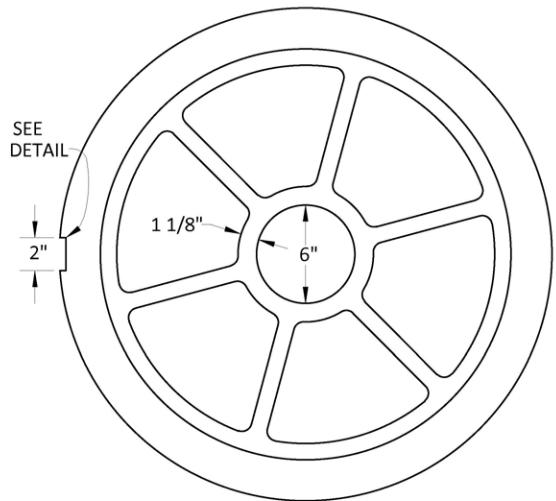
3 of 3

102-3

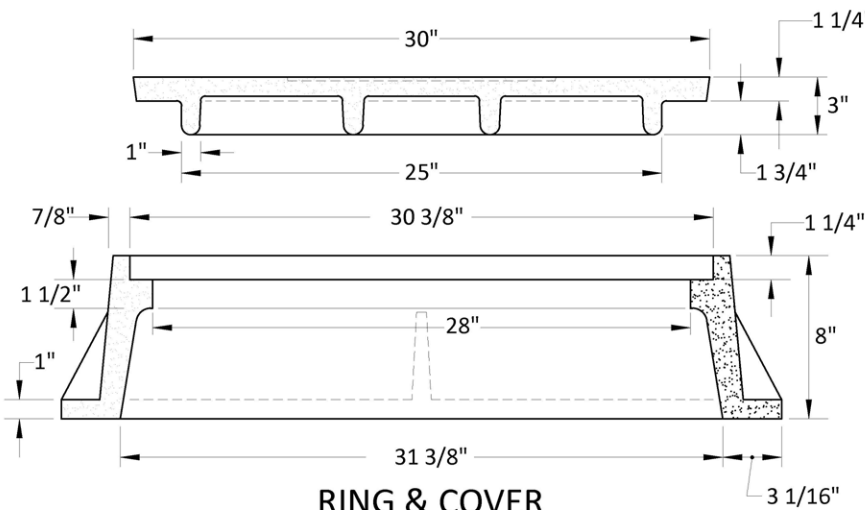
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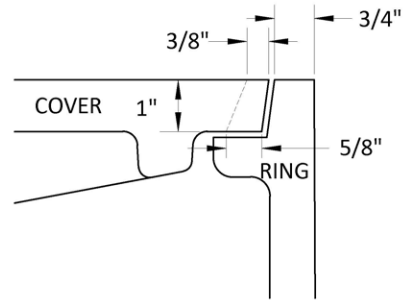
TOP VIEW



UNDERSIDE VIEW  
OF COVER



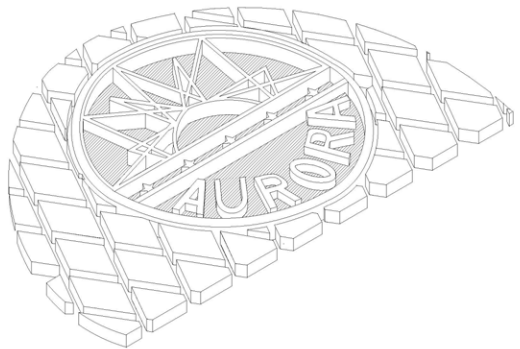
RING & COVER



DETAIL-LIFTING NOTCH

## NOTES:

1. A.S.T.M. DESIGNATION A-48-83 CLASS 25B (UNPAINTED).
2. ALL BEARING SURFACES TO BE MACHINED.
3. LETTERING ON COVER AS REQUIRED (WATER, SANITARY, OR STORM).
4. AURORA STANDARD-NEENAH R-1798, OR EQUAL, TOTAL MINIMUM WEIGHT APPROXIMATELY 575 LBS, MINIMUM FRAME WEIGHT -295 LBS., MINIMUM LID WEIGHT-280 LBS. LOAD REQUIREMENTS MUST BE IN CONFORMANCE WITH HS20 STANDARDS.
5. LIFTING NOTCH SHALL NOT EXTEND PAST INSIDE FACE OF RING SEAT.
6. SEE SECTION 10.00 FOR SPECIFICATIONS.
7. CITY OF AURORA LABELING IS NOT TO BE INCLUDED ON PRIVATE INFRASTRUCTURE.



DETAIL-COVER DESIGN

TYPE "C" DESIGN: 1"X 1" SCORED 1/32"± DEEP



*David A. Reck*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

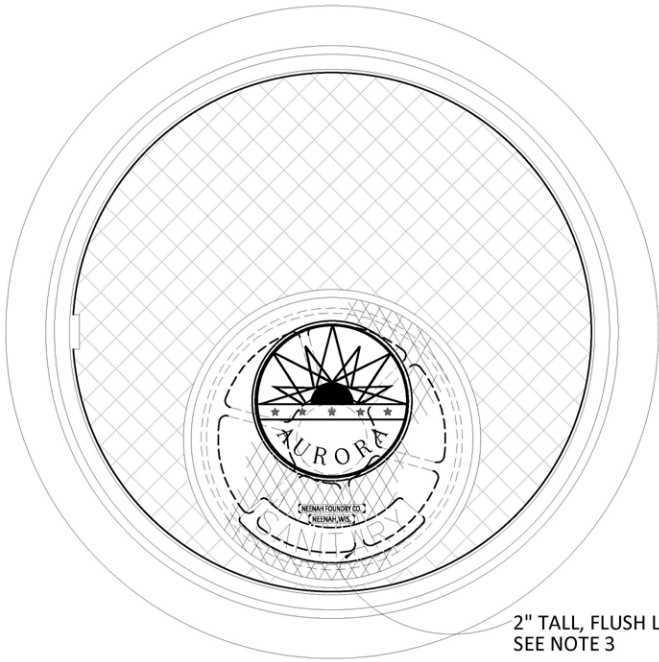
09/23/2019  
DATE

30" MANHOLE  
RING & COVER

1 of 1

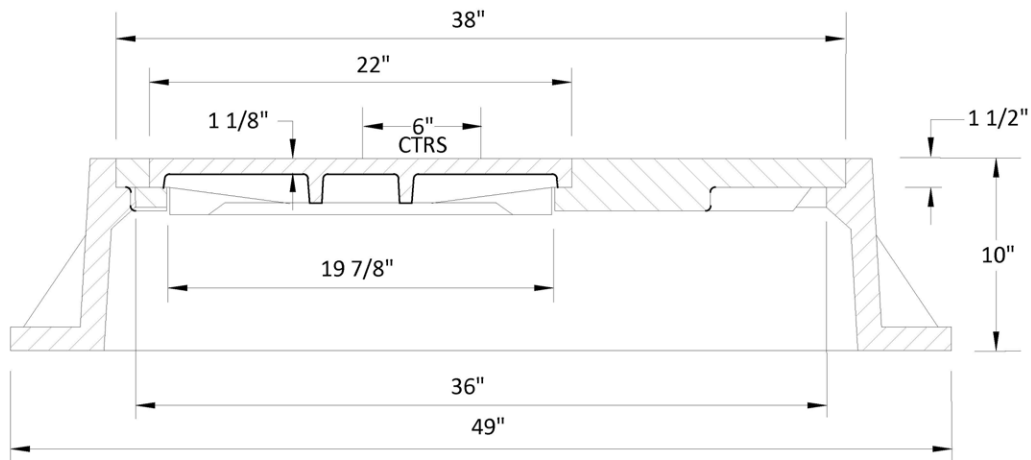
103-1

# STANDARD



36" LID W/ 22" ACCESS LID  
NEENAH R-1741D OR APPROVED EQUAL

2" TALL, FLUSH LETTERS  
SEE NOTE 3



## RING & COVER

### NOTES:

1. A.S.T.M. DESIGNATION A-48-83 CLASS 25B (UNPAINTED).
2. ALL BEARING SURFACES TO BE MACHINED.
3. LETTERING ON COVER AS REQUIRED (WATER, SANITARY, OR STORM).
4. AURORA STANDARD-NEENAH R-1741-D, OR EQUAL, TOTAL MINIMUM WEIGHT APPROXIMATELY 350 LBS, MINIMUM FRAME WEIGHT -170 LBS., MINIMUM LID WEIGHT-180 LBS.
5. LIFTING NOTCH SHALL NOT EXTEND PAST INSIDE FACE OF RING SEAT.
6. SEE SECTION 10.00 FOR SPECIFICATIONS.
7. CITY OF AURORA LABELING IS NOT TO BE INCLUDED ON PRIVATE INFRASTRUCTURE.



*David A. Rashell*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

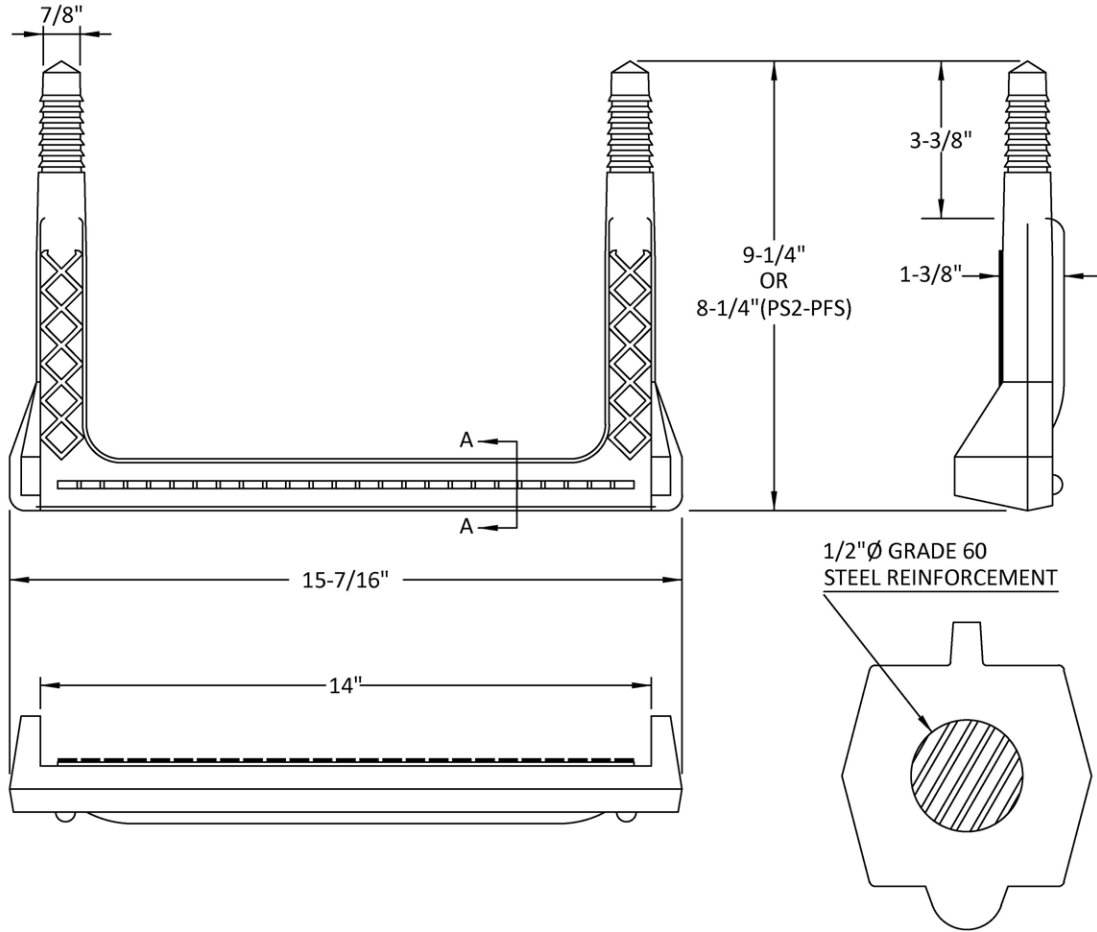
09/25/2019  
DATE  
09/23/2019  
DATE

36" MANHOLE  
RING & COVER

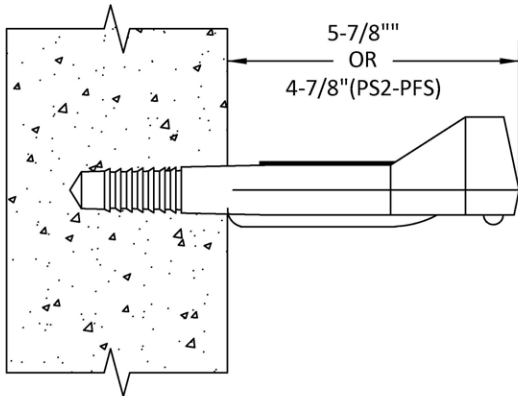
1 of 1

104-1

# STANDARD



SECTION A-A



IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO REPLACE TOP STEPS AS NECESSARY WITH MODEL NO. PS2-PF-HH (SEE DETAIL 105-2) IF 20" OF CLEARANCE CANNOT BE MAINTAINED.

## NOTES:

1. AS MANUFACTURED BY M.A. INDUSTRIES. PART NO. PS2-PF OR PS2-PFS
2. CAPACITY: 2,500 LBS. WITH STEP EXTENDED 6-3/8" FROM WALL.
3. MATERIAL: COPOLYMER POLYPROPYLENE PLASTIC, WITH 1/2"Ø GRADE 60 STEEL REINFORCEMENT.



*David A. Reheul*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

09/23/2019  
DATE

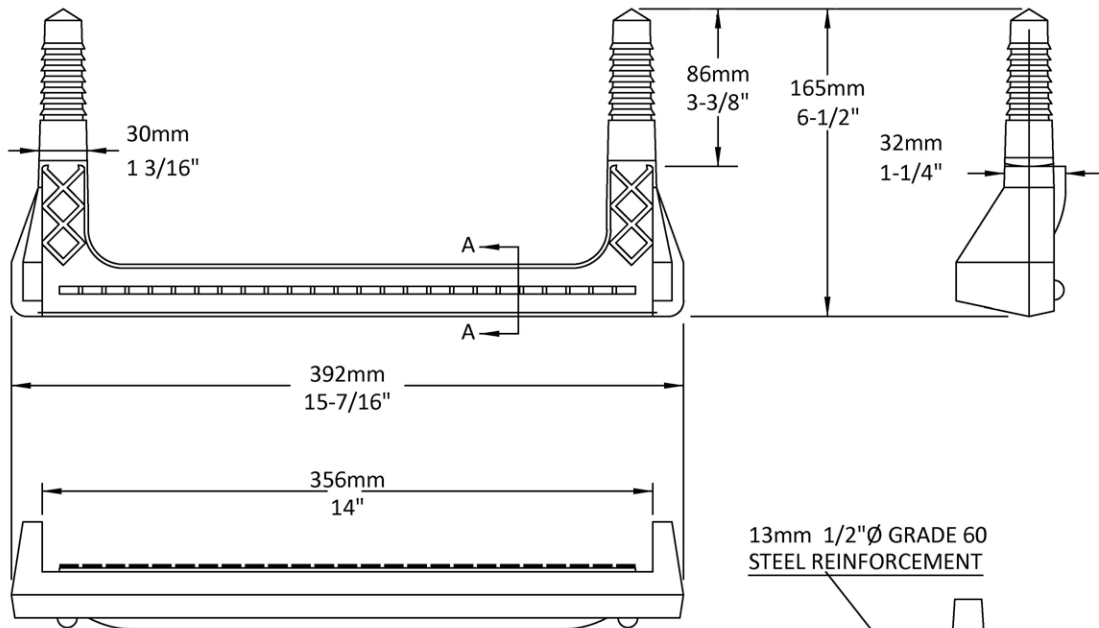
MANHOLE STEP

1 of 2

105-1

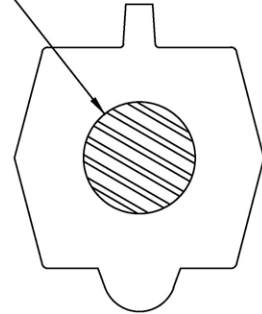


# STANDARD

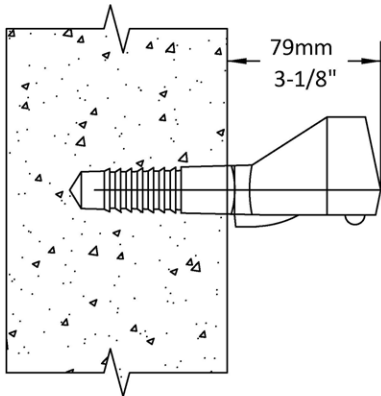


COPOLYMER POLYPROPYLENE PLASTIC

13mm 1/2"Ø GRADE 60  
STEEL REINFORCEMENT



SECTION A-A



## NOTES:

1. THIS STEP, PART NO. PS2-PF-HH, AS MANUFACTURED BY M. A. INDUSTRIES, INC. SHALL BE USED WHENEVER 20 INCHES OF CLEARANCE CANNOT BE MAINTAINED AT THE TOP STEP, USING DETAIL 105-1. MEASUREMENT SHALL BE TAKEN FROM THE FACE OF THE STEP TO THE INNER WALL OF THE MANHOLE.



*David A. Reilly*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

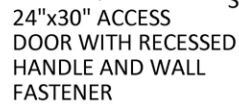
09/25/2019  
DATE  
09/23/2019  
DATE

MANHOLE STEP

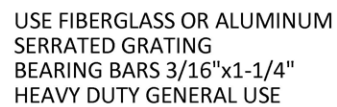
2 of 2

105-2

\\AURORA\FILES\DEPT\PUBLIC WORKS\PWD\PWD\STANDARD\UTIL-STD\2019 REVISION\106-1.DWG



## PLATFORM DETAIL



## GRATE DETAIL

**NOTES**  
1. LANDING PLATFORMS SHALL ONLY BE PROVIDED AT LOCATIONS AS SPECIFIED ON APPROVED PROJECT DRAWINGS.



AURORA  
WATER

  
CITY ENGINEER

09/25/2019  
DATE

Vernon A. Adam  
AURORA WATER

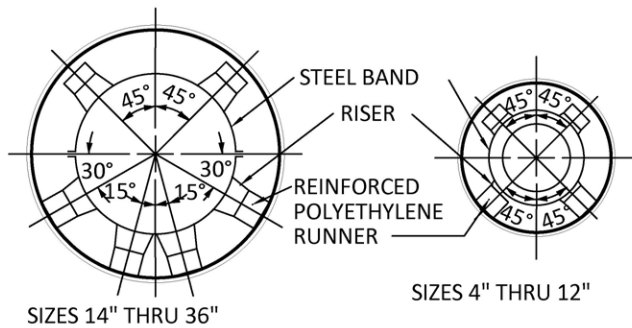
09/23/2019  
DATE

1 of 1

106-1

# STANDARD

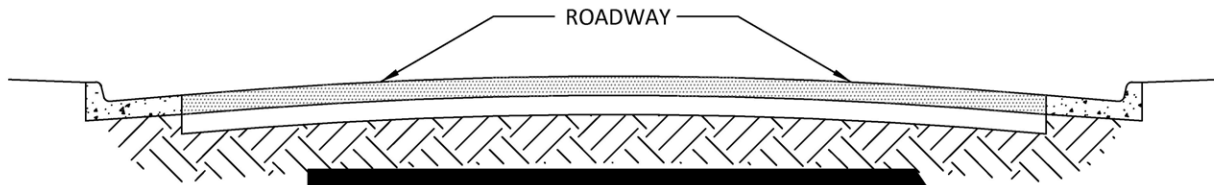
## TYPICAL STEEL ENCASEMENT CONSTRUCTION



**RUNNER CONFIGURATION**

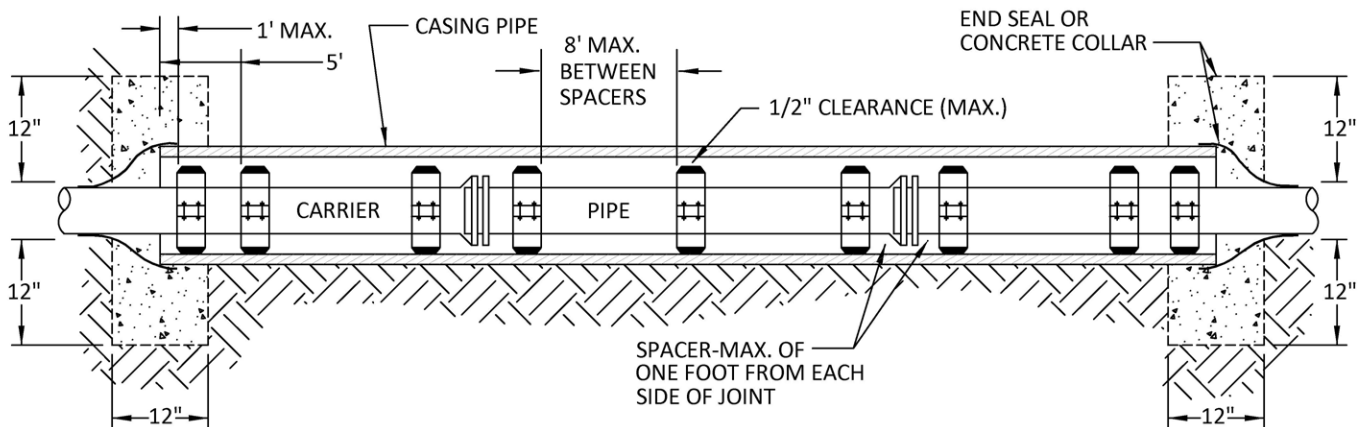
CARRIER PIPE	CASING PIPE	
NOMINAL DIA.	MIN. I.D.	MIN. WALL THICKNESS
4"	12"	0.250"
6"	16"	0.250"
8"	18"	0.282"
12"	23"	0.344"
16"	30"	0.406"
24"	40"	0.469"

CASING CHOCKS SHALL MEET OR EXCEED  
 PSI MODEL C8G-2 OR C12G-2  
 APS MODEL SI  
 POWERSEAL 4810  
 RESTRAINED CASING SPACER BY UNI-FLANGE



### STEEL CASING INFORMATION REQUIRED ON CONSTRUCTION PLANS

1. LENGTH AND TIES TO ENDS OF CASING
2. THICKNESS IN INCHES
3. INSIDE DIAMETER



### NOTES:

- JOINT RESTRAINT PIPE SHALL BE USED FOR CARRIER PIPE THROUGH ALL BORES. P.V.C.(A.S.T.M.-D3034-SDR 35) MAY BE USED FOR SANITARY SEWERS ON BORES OF 100' OR LESS IN LENGTH. DUCTILE IRON PIPE SHALL BE POLYWRAPPED.
- IF THE BORE IS NOT CONSTRUCTED TO THE PROPER GRADE AN ADDITIONAL MANHOLE SHALL BE INSTALLED AT THE GRADE CHANGE.
- THE CASING SHALL BE SEALED WITH CONCRETE COLLARS OR ENDSEALS. NO SPIRAL WELDED STEEL CASING PIPE SHALL BE USED.
- THE PIPE AND CASING SHALL BE INSULATED BY USE OF CASING CHOCKS. ALL POLYETHYLENE CHOCKS ARE NOT ALLOWED.
- STEEL CASING SHALL BE FACTORY COATED FOR DIRECT BURY APPLICATIONS. 48 lb ANODES SHALL BE INSTALLED AT BOTH ENDS OF CASING FOR BORED APPLICATIONS.



**AURORA  
WATER**

*David A. Schull*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

09/23/2019  
DATE

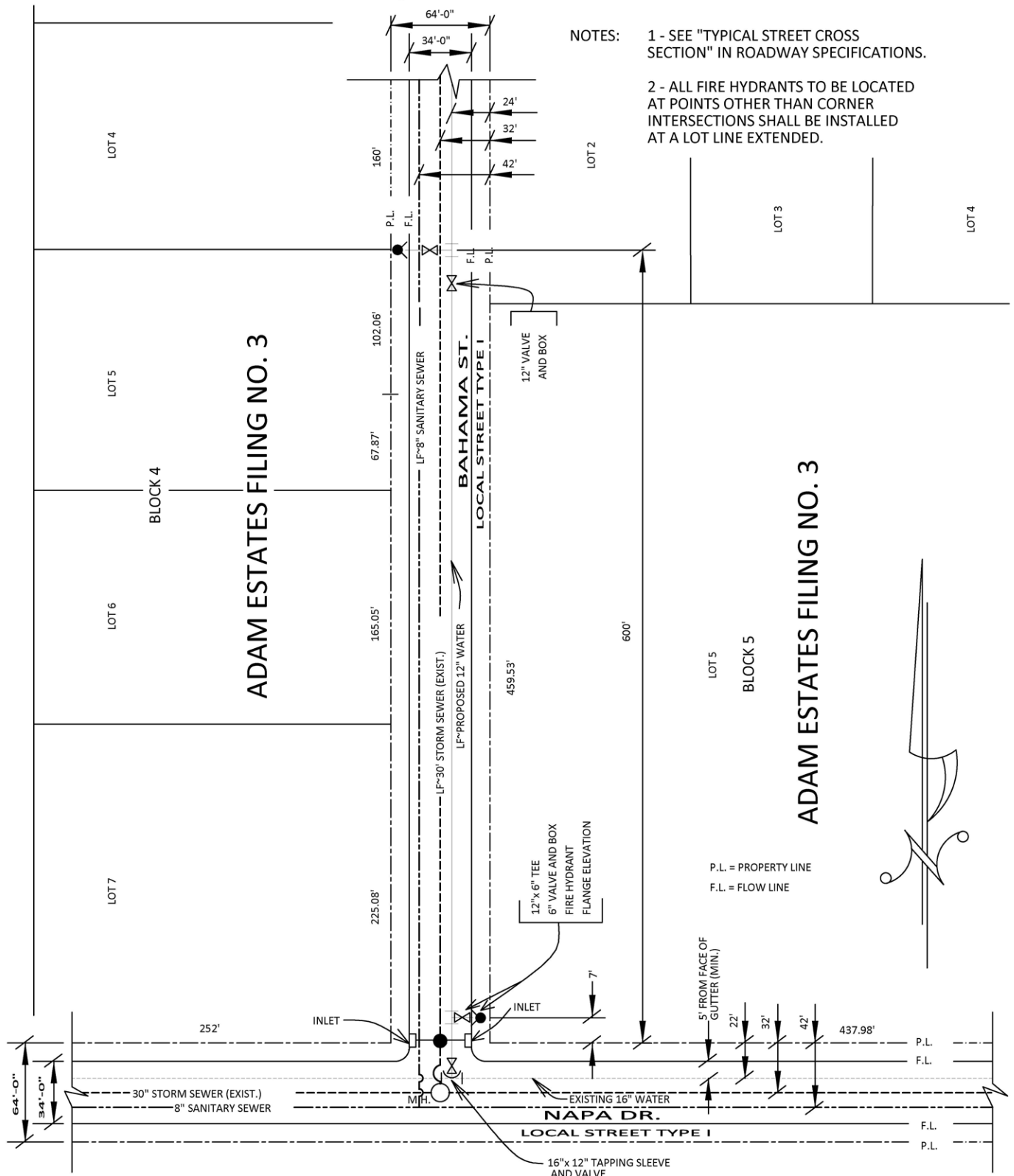
**TYPICAL STEEL  
ENCASEMENT  
CONSTRUCTION**

1 of 1

**107-1**



## STANDARD



AURORA  
WATER

  
CITY ENGINEER

09/25/2019  
DATE

Vernon A. Adam  
AURORA WATER

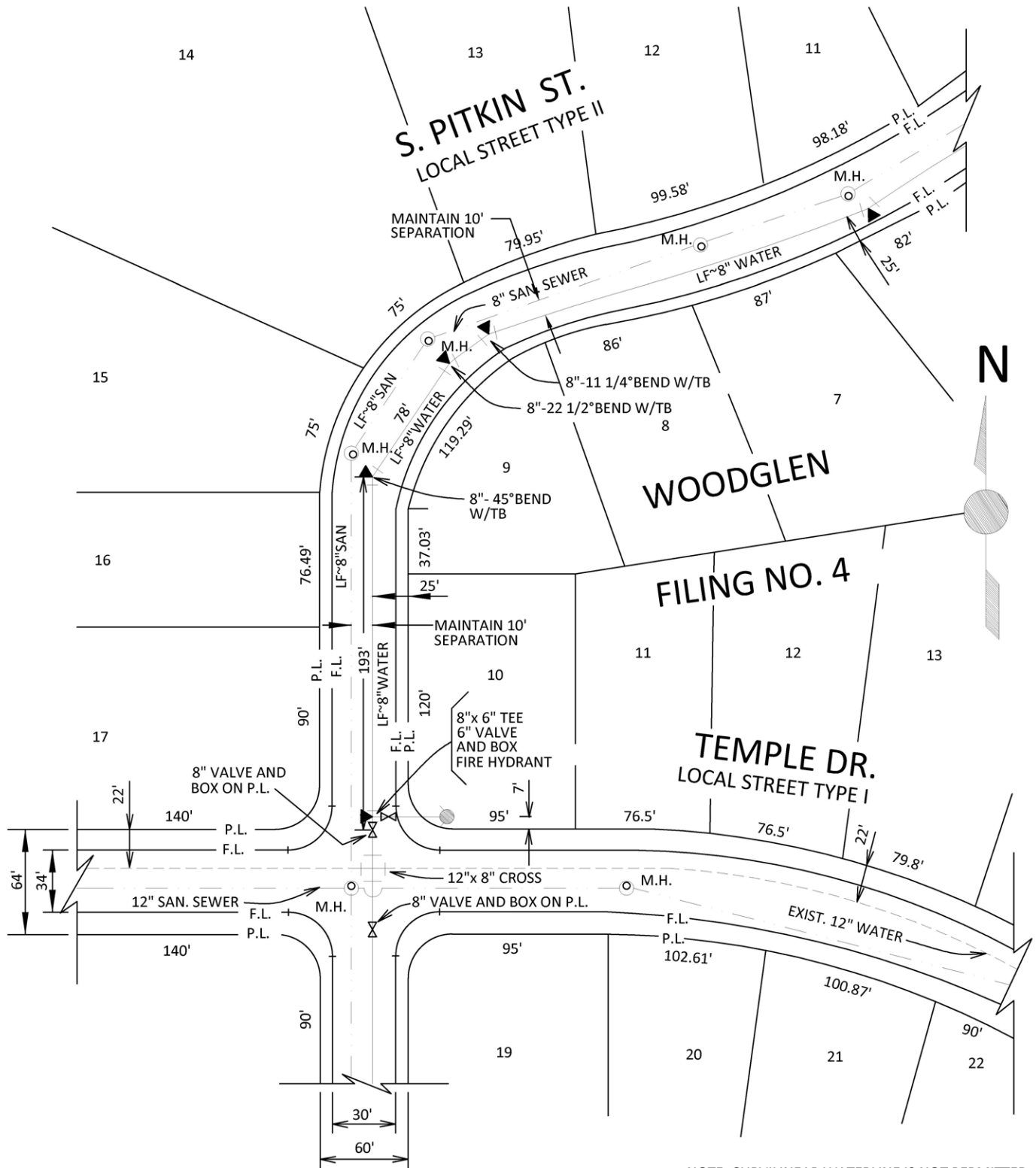
09/23/2019  
DATE

## DISTRIBUTION SYSTEM TYPICAL PLAN

1 of 1

108-1

# STANDARD



*David A. Reheult*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

09/25/2019  
DATE  
09/23/2019  
DATE

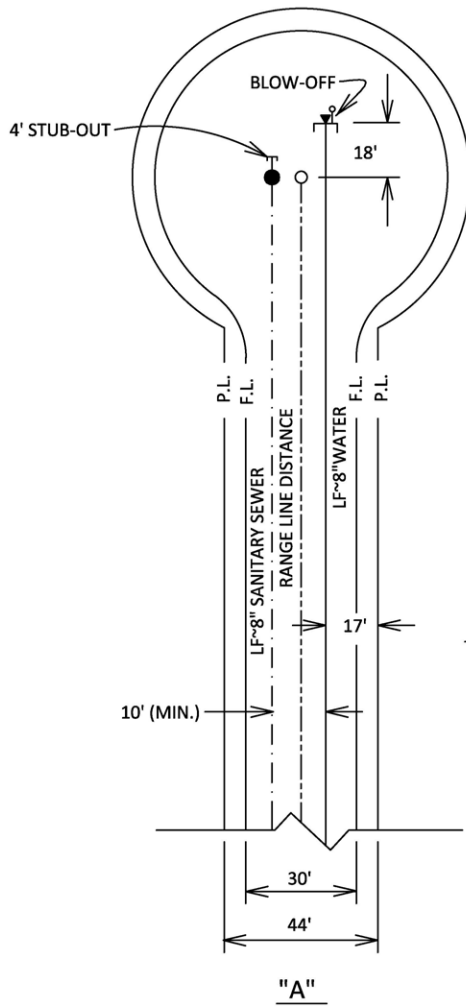
DISTRIBUTION SYSTEM  
TYPICAL PLAN FOR  
CURVED STREETS

1 of 1

109-1

\\AURORA\FILES\DEPT\PUBLIC WORKS\PWD\DRAWING\STANDARD\UTIL-STD\2019 REVISION\109-1.DWG

# STANDARD

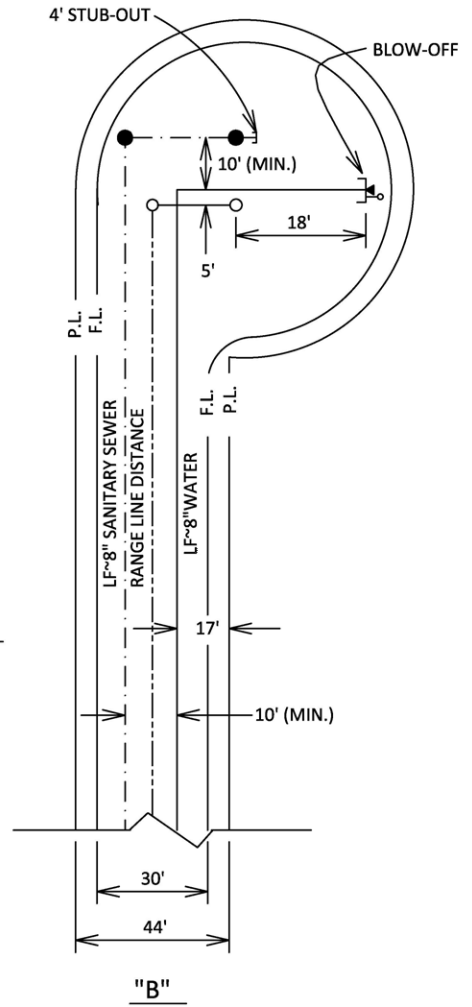


## "A" - STRAIGHT LINE CUL-DE-SAC:

LAY WATER PIPE TO 18'  
BEYOND THE CENTER  
(RADIUS POINT)  
OF CUL-DE-SAC.

## "B" - OFFSET CUL-DE-SAC

LAY WATER PIPE  
TO 5' BEYOND P.I. THEN  
TO 18' BEYOND CENTER  
(RADIUS POINT) OF  
CUL-DE-SAC.



LOCAL STREET TYPE 2 ALTERNATIVE

### NOTE:

1. RESIDENTIAL CUL-DE-SAC LESS THAN 250' IN LENGTH SEE C.O.A. ROADWAY SPECIFICATIONS FOR TYPICAL STREET CROSS SECTIONS.



*Christy A. Reubels*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

09/25/2019  
DATE  
09/23/2019  
DATE

## DISTRIBUTION SYSTEM TYPICAL PLAN FOR CUL-DE-SACS

1 of 1

110-1

# STANDARD

## PROCEDURES TO BE FOLLOWED BY THE CONTRACTOR FOR CONSTRUCTION OF WATER METERS

CALL PDS INSPECTIONS AT 303-739-7385 BEFORE 3:30pm 24 HOURS PRIOR TO TAPPING THE MAIN FOR INSPECTION OF TAPS 2" AND SMALLER. CITY PERFORMS TAPS FOR 3" AND LARGER METERS-ALL EXCAVATION SUBJECT TO BACK SLOPING OR SHORING AND PROVIDE 18" OF CLEARANCE AROUND MAIN. CALL OPERATIONS SERVICE CENTER AT 303-326-8645 TO SCHEDULE TAPS FOR 3" AND LARGER.



CALL PDS INSPECTIONS AT 303-739-7385 TO OBTAIN A PERMIT AND SCHEDULE INSPECTION FOR SERVICE LINE FROM METER PIT TO BUILDING.



INSPECTION BY PROJECT DELIVERY SERVICES



CONTRACTOR MUST MAKE REPAIRS BEFORE RE-SCHEDULING.



CALL OPERATIONS SERVICE CENTER FOR METER SETTING BY 3:30pm FOR NEXT DAY INSTALLATION @ 303 326-8645.



CUSTOMER SERVICE WILL INSTALL METER UPON ACCEPTANCE OF METER PIT OR VAULT. IF REJECTED, A NOTICE OF DISCREPENCY WILL BE LEFT NEXT TO THE BUILDING PERMIT, IN VAULT, OR WITH CONSTRUCTION SUPERINTENDANT.



CONTRACTOR MUST MAKE FINAL REPAIRS BEFORE RE-SCHEDULING. REINSPECTION FEE WILL BE ASSESSED FOR EACH RE-INSPECTION.



METER SET

THE OWNER/DEVELOPER IS REQUIRED TO ADJUST THE GRADE OF THE PIT, YOKE OR LATERAL AS NECESSARY PRIOR TO METER SET IN ACCORDANCE WITH APPLICABLE STANDARDS.



AURORA  
WATER

*David A. Reheult*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

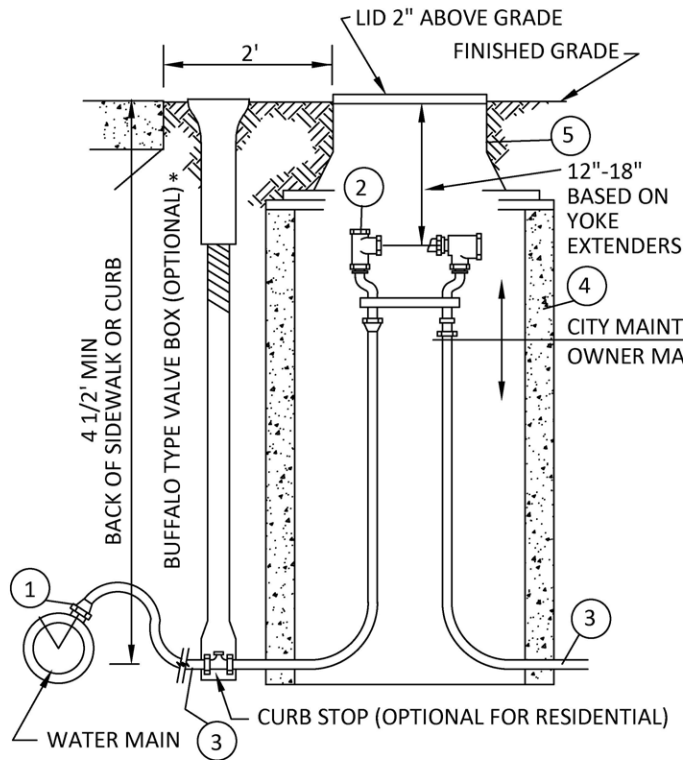
09/23/2019  
DATE

METER INSTALLATION  
PROCEDURE

1 of 1

200-1

# STANDARD



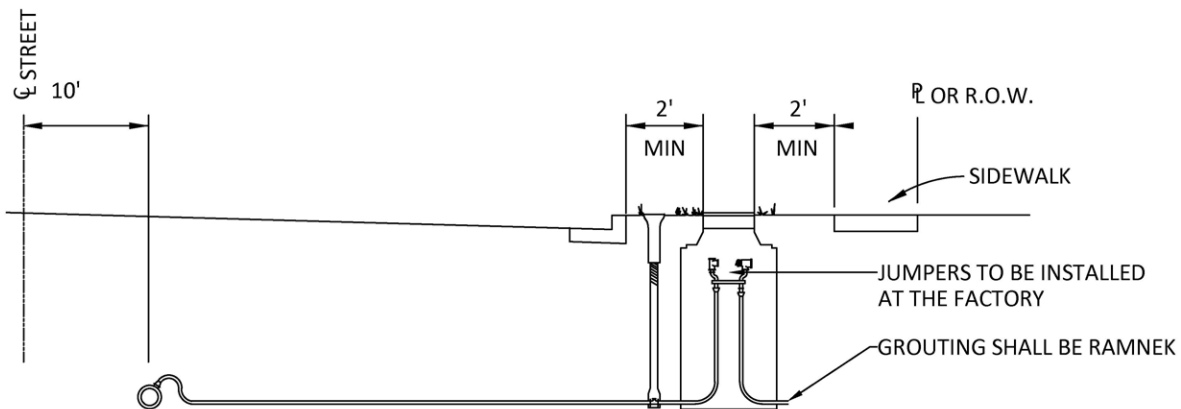
## DESCRIPTION:

1. CORPORATION STOP AND INSULATOR - LOCATED AT 10 OR 2 O'CLOCK ON CIRCUMFERENCE OF PIPE. FURNISHED AND INSTALLED BY DEVELOPER AND POLYWRAPPED ACCORDING TO DIPRA SPECIFICATIONS.
2. LOCKING SHUT OFF VALVE.
3. SERVICE LINE - COPPER TUBING (TYPE "K")
4. METER PIT: 24" I.D. x 28" O.D. x 4'. SEE APPROVED PRODUCTS LIST.
5. METER PIT HOOD (SEE DETAIL 202).

SERVICE TYPE	YOKE SIZE
$\frac{3}{4}$ " RESIDENTIAL	$\frac{5}{8}$ " X $\frac{3}{4}$ "
$\frac{3}{4}$ " COMMERCIAL	$\frac{3}{4}$ " X $\frac{3}{4}$ "
1" COMMERCIAL	1" X 1"

## NOTES:

1. WATER METER FURNISHED AND INSTALLED BY AURORA WATER.
2. SERVICE LINE MUST HAVE A MINIMUM COVER OF 4 1/2 FEET.
3. METER PIT MUST BE AT LEAST 2' FROM ANY HARDSCAPE AS MEASURED FROM EDGE OF LID; HARDSCAPE TO BE INSTALLED PRIOR TO METER SET.
4. CALL PDS INSPECTIONS AT 303-739-7385 FOR WATER SERVICE LINES INSPECTIONS PRIOR TO BACKFILLING.
5. \*VALVE BOX AND CURB STOP ARE OPTIONAL FOR RESIDENTIAL - MANDATORY FOR COMMERCIAL, IRRIGATION, AND ALL SERVICES TAPPED OFF 16" MAINS AND LARGER. CURB STOP SHALL NOT BE LOCATED IN STREET, GUTTER OR SIDEWALK.
6. THE OWNER/DEVELOPER IS REQUIRED TO ADJUST THE GRADE OF THE PIT, YOKE, OR LATERAL IF NECESSARY PRIOR TO METER SET IN ACCORDANCE WITH APPLICABLE STANDARDS.
7. METER SETTER MUST HAVE INTEGRAL OUTLET SPRING CHECK VALVE.

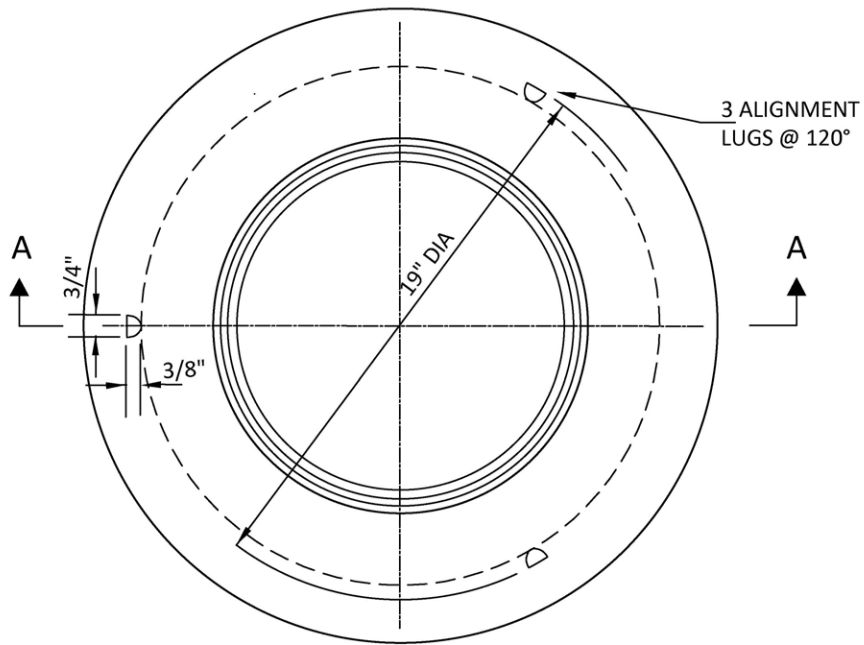


CITY ENGINEER  
 09/25/2019  
 DATE  
  
 AURORA WATER  
 09/23/2019  
 DATE

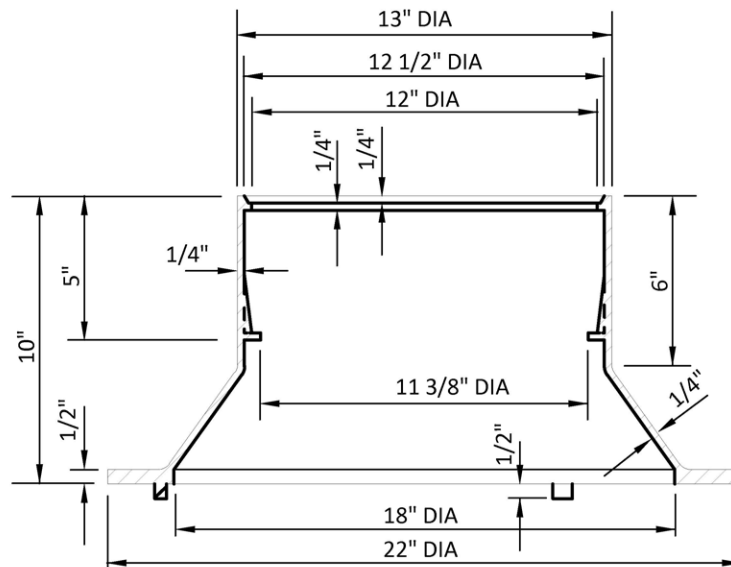
METER INSTALLATION  
 $\frac{3}{4}$ " & 1" SERVICE

1 of 1  
 201-1

# STANDARD



## PIT COVER



## SECTION A-A

### NOTES:

1. THE HOOD MAY BE COMPOSITE OR CAST IRON
2. THE LIDS SHALL BE COMPOSITE MATERIAL MANUFACTURED FROM CITY PRE-APPROVED VENDORS
3. ADDRESS TAGS ARE REQUIRED FOR BANKED METER PITS TAGS SHALL BE ATTACHED TO THE YOKE AND THE LID



*David A. Ruch*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

09/25/2019  
DATE  
09/23/2019  
DATE

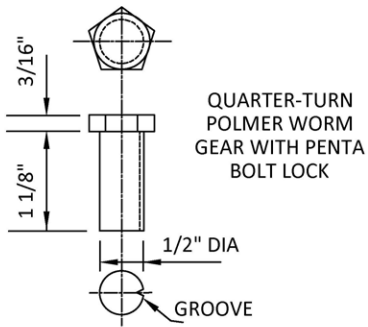
METER PIT COVER

1 of 2

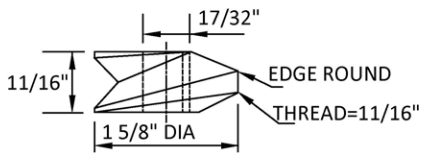
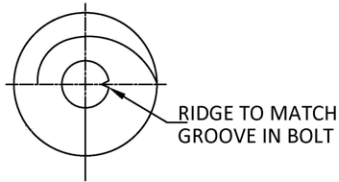
202-1



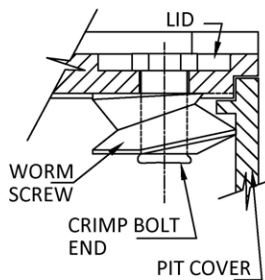
# STANDARD



**BOLT DETAIL**

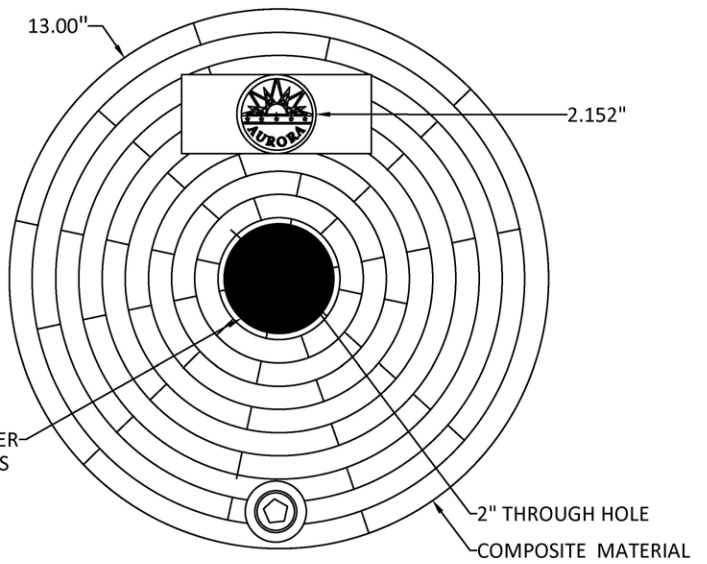


**WORM SCREW  
DETAIL**

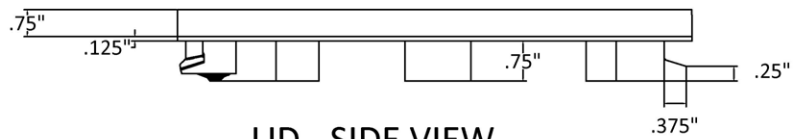


**ASSEMBLY DETAIL**

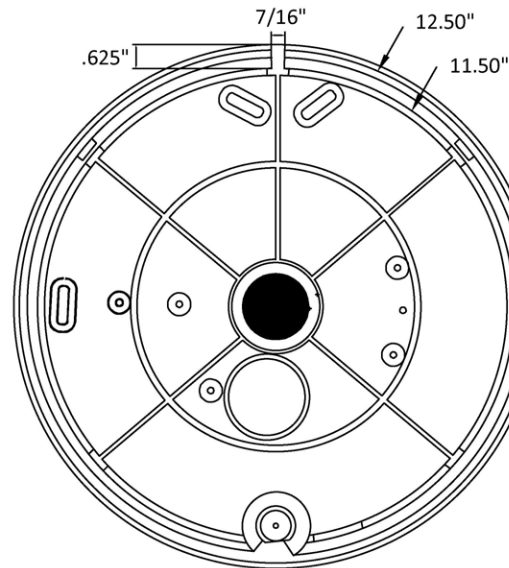
**NOTE:** ADDRESS TAGS ARE REQUIRED FOR BANKED METER  
PITS TAGS SHALL BE ATTACHED TO THE YOKE AND THE LID



**LID - TOP VIEW**



**LID - SIDE VIEW**



**LID - BOTTOM VIEW**



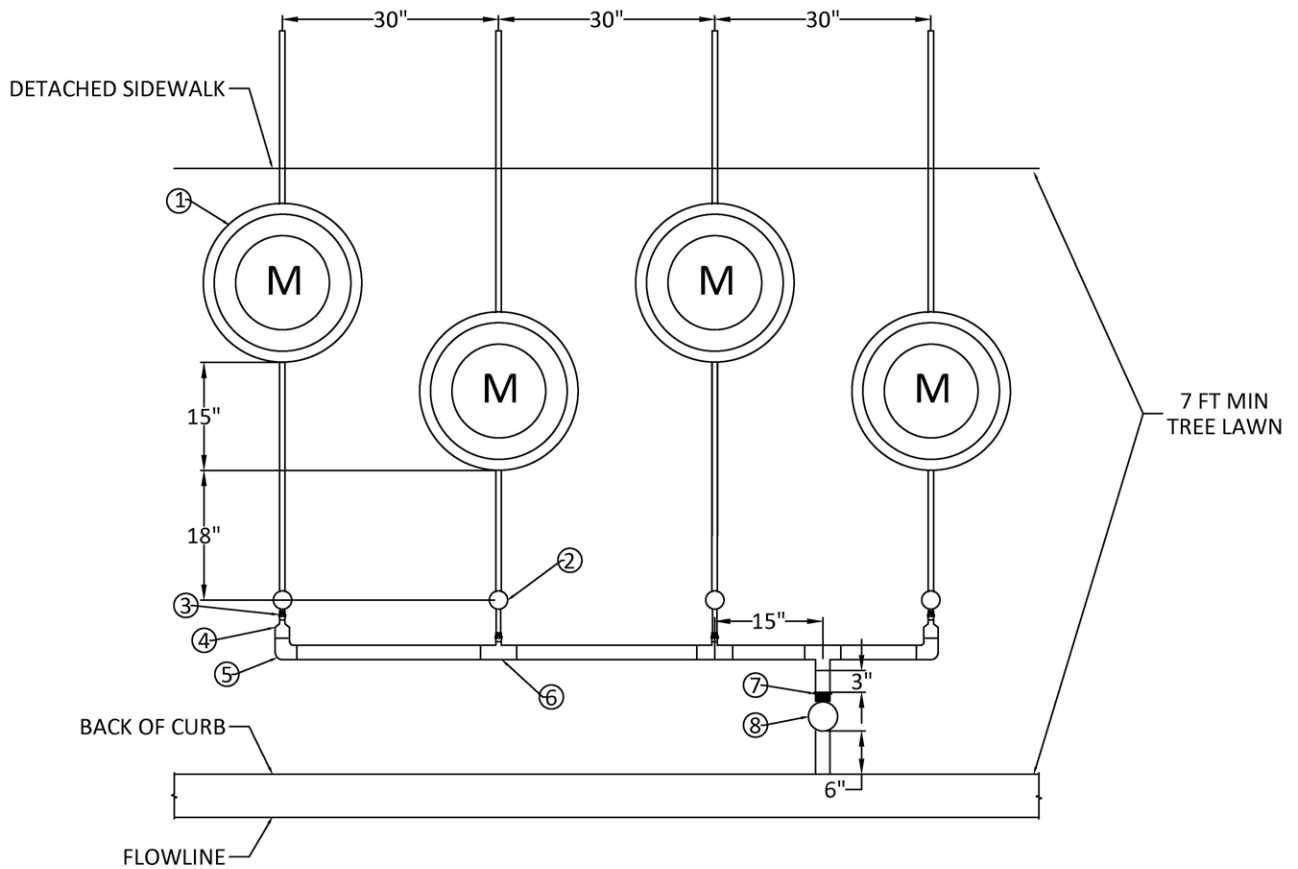
*Vernon A. Adam*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

09/25/2019  
DATE  
09/23/2019  
DATE

METER PIT  
COVER 3/4" & 1"

2 of 2  
**202-2**

# STANDARD



## MATERIALS:

1. 24 INCH METER PIT (SEE DETAIL 201 AND 202)
2.  $\frac{3}{4}$  INCH SECONDARY CURB STOP AND BOX
3.  $\frac{3}{4}$  INCH FTG x MIP ADAPTER
4. 2 INCH FTG x  $\frac{3}{4}$  INCH C REDUCER
5. 2 INCH C x C 90 ELBOW
6. 2 x  $\frac{3}{4}$  C x C x C TEE
7. 2 INCH MIP ADAPTER
8. 2 INCH CURB STOP AND BOX



1  $\frac{3}{4}$ " BRASS TAG  
WITH HOLE TO  
SECURE TO LID

## NOTES:

1. METER PITS PLACED INLINE SHALL BE SPACED 36 INCHES APART. METER PITS PLACED STAGGERED (AS SHOWN) SHALL BE SPACED 30 INCHES APART.
2. SEE DETAIL 201 FOR ADDITIONAL INFORMATION ON METER PIT.
3. ALL FITTINGS USED OUTSIDE OF MANIFOLD SHALL BE COMPRESSION TYPE
4. THERE SHALL BE A MAXIMUM OF FOUR PITS PLACED FOR EACH MANIFOLD
5. ADDRESS TAGS ARE REQUIRED FOR BANK METERS. TAGS SHALL BE ATTACHED TO BOTH THE YOKE AND THE LID.



AURORA  
WATER

*David A. Russell*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

09/25/2019  
DATE  
09/23/2019  
DATE

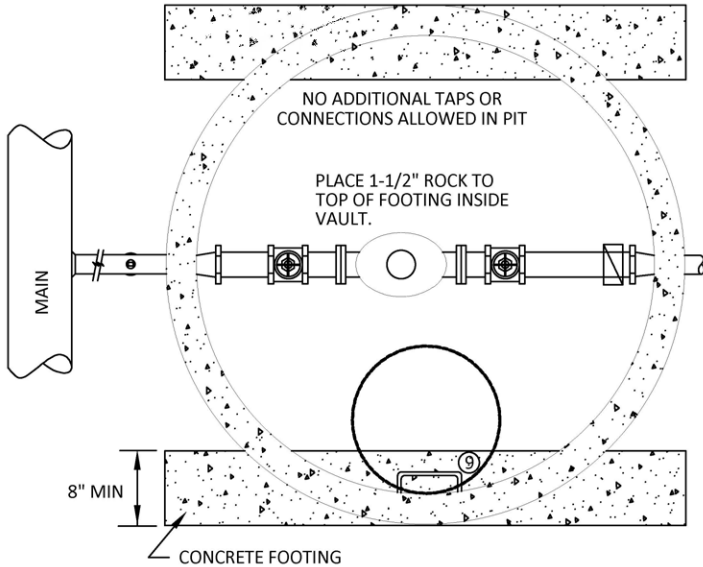
BANKED METER PIT

1 of 1

203-1

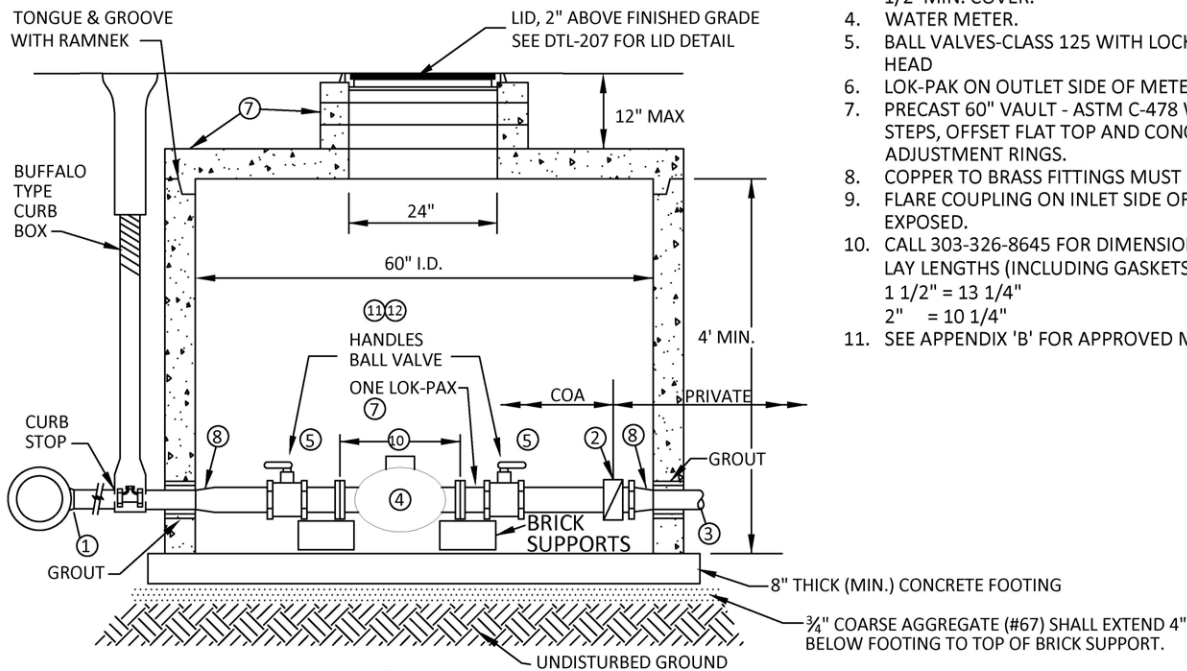


# STANDARD



PLAN

MAXIMUM OF 2-2" ADJUSTMENT RINGS. PLACE THICKER ADJUSTMENT RING DIRECTLY ON VAULT LID. RAMNEK BETWEEN ALL SURFACES OF MANHOLE LID AND RING AND COVER.



ELEVATION

## NOTES:

1. WATER METER FURNISHED AND INSTALLED BY AURORA WATER.
2. SERVICE LINE MUST HAVE A MINIMUM COVER OF 4-1/2 FEET.
3. PDS INSPECTIONS WILL INSPECT THE SERVICE LINE PRIOR TO BACK-FILLING.
4. NO JUMPERS ARE ALLOWED IN IRRIGATION METERS THAT DO NOT UTILIZE THE OUTLET CHECK VALVE. ALL CONSTRUCTION SOURCES SHOULD BE DOWNSTREAM OF THE OUTLET CHECK VALVE. CONTRACTORS SHALL BE RESPONSIBLE FOR ANY CHANGES OR DAMAGES DUE TO SHUT-OFF.
5. CONCRETE SHALL NOT BE LAID IN FLOOR OF METER PIT.
6. FOOTINGS ARE TO BE INSTALLED UNDER METER PIT.
7. FIELD SOLDERED JOINTS OR PLASTIC PIPE NOT ALLOWED IN METER PIT.
8. IRRIGATION METERS REQUIRE RP DEVICE.
9. TOP STEP TO BE 18"-24" BELOW SURFACE. STEPS TO BE SPACED 12" APART VERTICALLY.
10. CURB STOP VALVE ON UPSTREAM SIDE SHOULD BE LOCATED NO FURTHER THAN 3 FEET FROM OUTSIDE OF VAULT.
11. NO SHRUBS ALLOWED WITHIN 5' OF LID
12. CONCRETE COLLARS ARE REQUIRED WHEN A CURB BOX IS LOCATED WITHIN A LANDSCAPE AREA.

## MATERIALS:

1. CORPORATION STOP AND INSULATING COUPLING
2. FULLY ENCLOSED SWING CHECK VALVE ON OUTLET REQUIRED.
3. WATER SERVICE LINE - COPPER TUBING, (TYPE K) - 4 1/2' MIN. COVER.
4. WATER METER.
5. BALL VALVES-CLASS 125 WITH LOCK WING AND TEE HEAD
6. LOK-PAK ON OUTLET SIDE OF METER.
7. PRECAST 60" VAULT - ASTM C-478 WITH MANHOLE STEPS, OFFSET FLAT TOP AND CONCRETE ADJUSTMENT RINGS.
8. COPPER TO BRASS FITTINGS MUST BE EXPOSED.
9. FLARE COUPLING ON INLET SIDE OF METER MUST BE EXPOSED.
10. CALL 303-326-8645 FOR DIMENSION. LAY LENGTHS (INCLUDING GASKETS)  
1 1/2" = 13 1/4"  
2" = 10 1/4"
11. SEE APPENDIX 'B' FOR APPROVED MATERIALS



*Steph A. Reshull*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

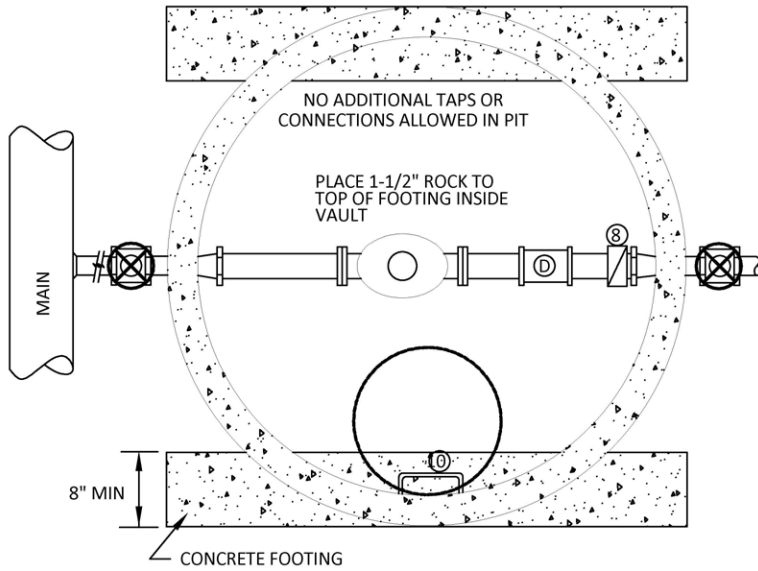
09/25/2019  
DATE  
09/23/2019  
DATE

1 1/2" DISC & 2" TURBINE  
IRRIGATION METER VAULT  
INSTALLATION

1 of 2

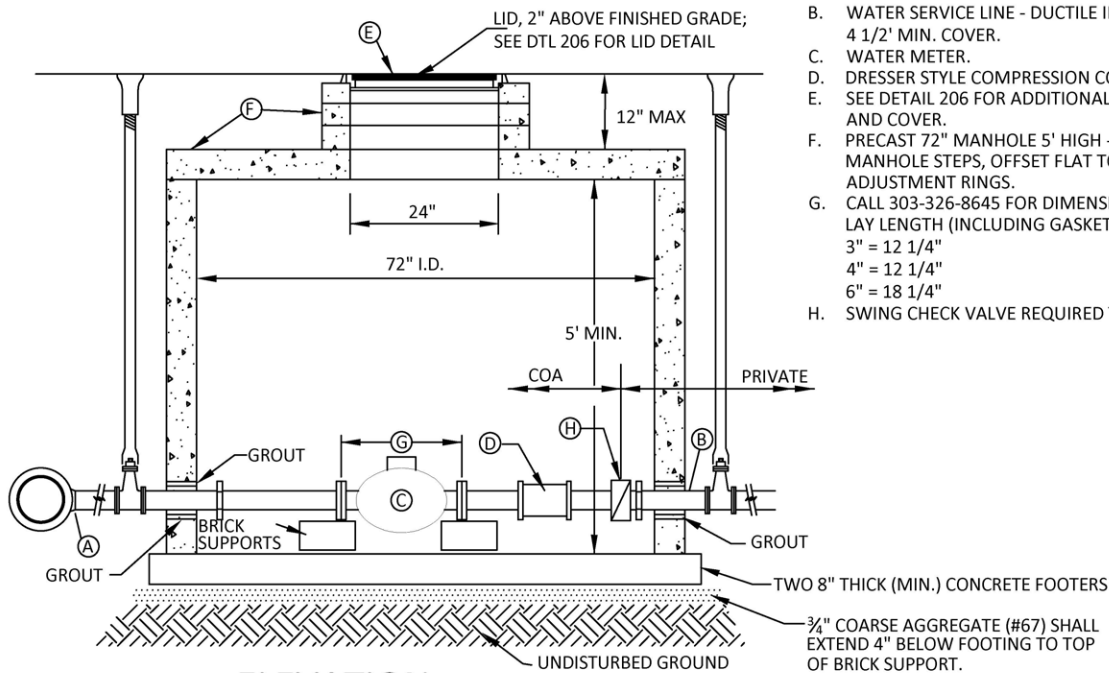
204-1

# STANDARD



PLAN

MAXIMUM OF 2-2" ADJUSTMENT RINGS. PLACE THICKER ADJUSTMENT RING DIRECTLY ON VAULT LID. REMNEK BETWEEN ALL SURFACES OF MANHOLE LID AND RING AND COVER.



ELEVATION

## NOTES:

1. WATER METER FURNISHED AND INSTALLED BY AURORA WATER.
2. SERVICE LINE MUST HAVE A MINIMUM COVER OF 4-1/2 FEET.
3. PDS INSPECTIONS WILL INSPECT THE SERVICE LINE PRIOR TO BACK-FILLING.
4. NO JUMPERS ARE ALLOWED IN IRRIGATION METERS CONTRACTORS SHALL BE RESPONSIBLE FOR ANY CHANGES OR DAMAGES DUE TO SHUT-OFF.
5. CONCRETE SHALL NOT BE LAID IN FLOOR OF METER PIT.
6. FOOTINGS ARE TO BE INSTALLED UNDER METER PIT.
7. FIELD SOLDERED JOINTS OR PLASTIC PIPE NOT ALLOWED.
8. IRRIGATION METERS REQUIRE RP DEVICE.
9. 1 1/2" TO 2" IRRIGATION METERS REFER TO 204.
10. TOP STEPS TO BE 18" - 24" BELOW SURFACE. STEPS TO BE SPACED 12" APART VERTICALLY.
11. GATE VALVE ON UPSTREAM SIDE SHOULD BE LOCATED NO FURTHER THAN 3 FEET FROM OUTSIDE OF VAULT.
12. NO SHRUBS ALLOWED WITHIN 5' OF LID.
13. CONCRETE COLLARS ARE REQUIRED WHEN A VALVE BOX IS LOCATED WITHIN A LANDSCAPED AREA.

## MATERIALS:

- A. TAPPING TEE AND VALVE (4 INCH MIN.) FURNISHED AND INSTALLED BY AURORA WATER ACCORDING TO LATEST FEE SCHEDULE. (TEE IN LEIU OF TAPPING SLEEVE ALLOWED IF NEW MAIN IS BEING CONSTRUCTED.)
- B. WATER SERVICE LINE - DUCTILE IRON, (PRESSURE CLASS 350) - 4 1/2' MIN. COVER.
- C. WATER METER.
- D. DRESSER STYLE COMPRESSION COUPLING.
- E. SEE DETAIL 206 FOR ADDITIONAL INFORMATION ON RING AND COVER.
- F. PRECAST 72" MANHOLE 5' HIGH - ASTM C-478 WITH MANHOLE STEPS, OFFSET FLAT TOP AND CONCRETE ADJUSTMENT RINGS.
- G. CALL 303-326-8645 FOR DIMENSION.  
3" = 12 1/4"  
4" = 12 1/4"  
6" = 18 1/4"
- H. SWING CHECK VALVE REQUIRED TO BE FULLY RESTRAINED.



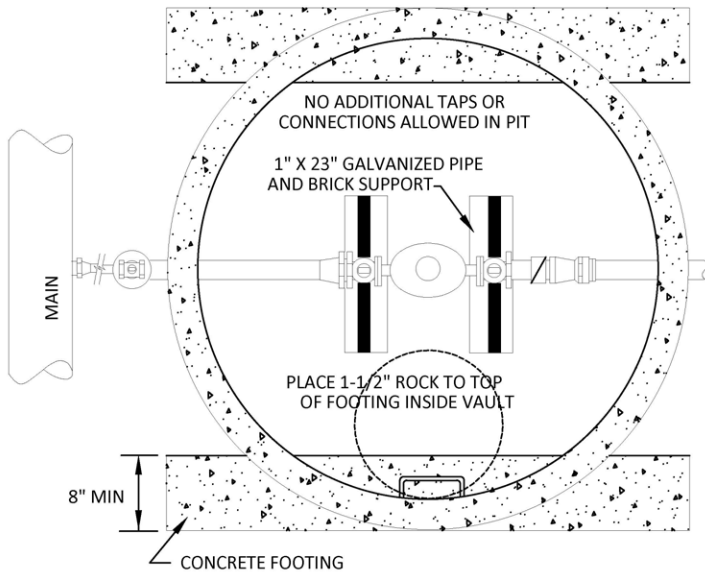
*Vernon A. Adam*  
CITY ENGINEER  
AURORA WATER

09/25/2019  
DATE  
09/23/2019  
DATE

3", 4" & 6" TURBINE IRRIGATION  
METER VAULT INSTALLATION

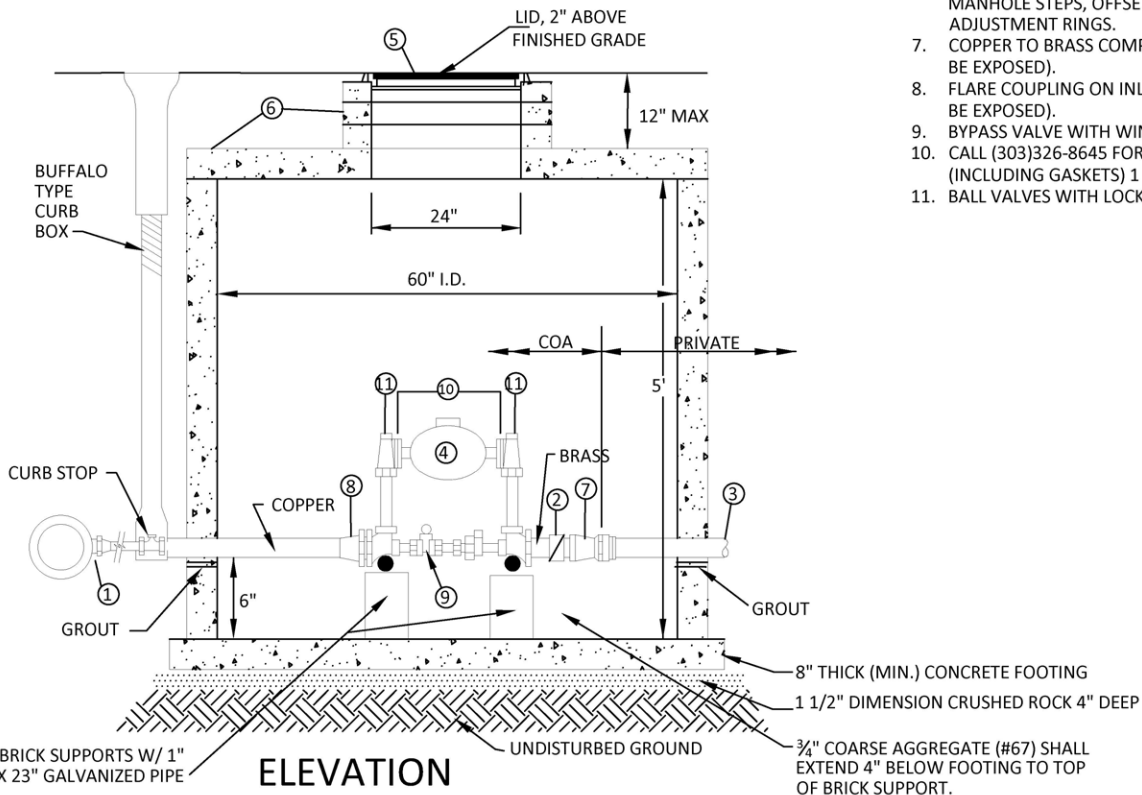
2 of 2  
204-2

# STANDARD



## PLAN

MAXIMUM OF 2-2" ADJUSTMENT RINGS. PLACE THICKER ADJUSTMENT RING DIRECTLY ON VAULT LID. RAMNEK BETWEEN ALL SURFACES OF MANHOLE LID AND RING AND COVER.



## ELEVATION

### NOTES:

1. IF THE SURFACE IS NOT TO FINAL GRADE AT THE TIME OF THE METER INSTALLATION, THE OWNER SHALL RAISE OR LOWER THE PIT TO MATCH THE FINAL GRADE.
2. METER PIT AND RELATED SERVICE UNIT MUST BE INSPECTED BY PDS INSPECTIONS PRIOR TO BACKFILLING.
3. NO CONCRETE TO BE LAID IN FLOOR OF METER PIT.
4. FOOTINGS TO BE INSTALLED UNDER METER PIT.
5. FIELD SOLDERED JOINTS OR PLASTIC PIPE NOT ALLOWED IN PIT.
6. PDS INSPECTIONS SHALL INSPECT THE SERVICE LINE PRIOR TO BACKFILLING.
7. TOP STEPS TO BE 18" - 24" BELOW SURFACE. STEPS TO BE SPACED 12" APART VERTICALLY.
8. CURB STOP VALVE ON UPSTREAM SIDE SHOULD BE LOCATED NO FURTHER THAN 3 FEET FROM OUTSIDE OF VAULT.
9. NO SHRUBS ALLOWED WITHIN 5' OF LID
10. CONCRETE COLLARS ARE REQUIRED WHEN A VALVE BOX IS LOCATED WITHIN A LANDSCAPED AREA.

### MATERIALS:

1. CORPORATION STOP AND INSULATING COUPLING - FURNISHED AND INSTALLED BY THE CONTRACTOR.
2. SWING CHECK VALVE ON OUTLET REQUIRED.
3. WATER SERVICE LINE - COPPER TUBING, TYPE 'K' - 4-1/2" MIN. COVER.
4. METER - FURNISHED AND INSTALLED BY AURORA WATER.
5. SEE DETAIL 207-1 FOR ADDITIONAL INFORMATION ON RING & COVER.
6. PRECAST 60" MANHOLE - ASTM C-478 WITH MANHOLE STEPS, OFFSET FLAT TOP AND CONCRETE ADJUSTMENT RINGS.
7. COPPER TO BRASS COMPRESSION FITTINGS (MUST BE EXPOSED).
8. FLARE COUPLING ON INLET SIDE OF METER (MUST BE EXPOSED).
9. BYPASS VALVE WITH WINGED LOCKING VALVE.
10. CALL (303)326-8645 FOR DIMENSIONS. LAY LENGTH (INCLUDING GASKETS) 1 1/2" = 13 1/4" 2" = 17 1/4"
11. BALL VALVES WITH LOCK WINGS.



*David A. Russell*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

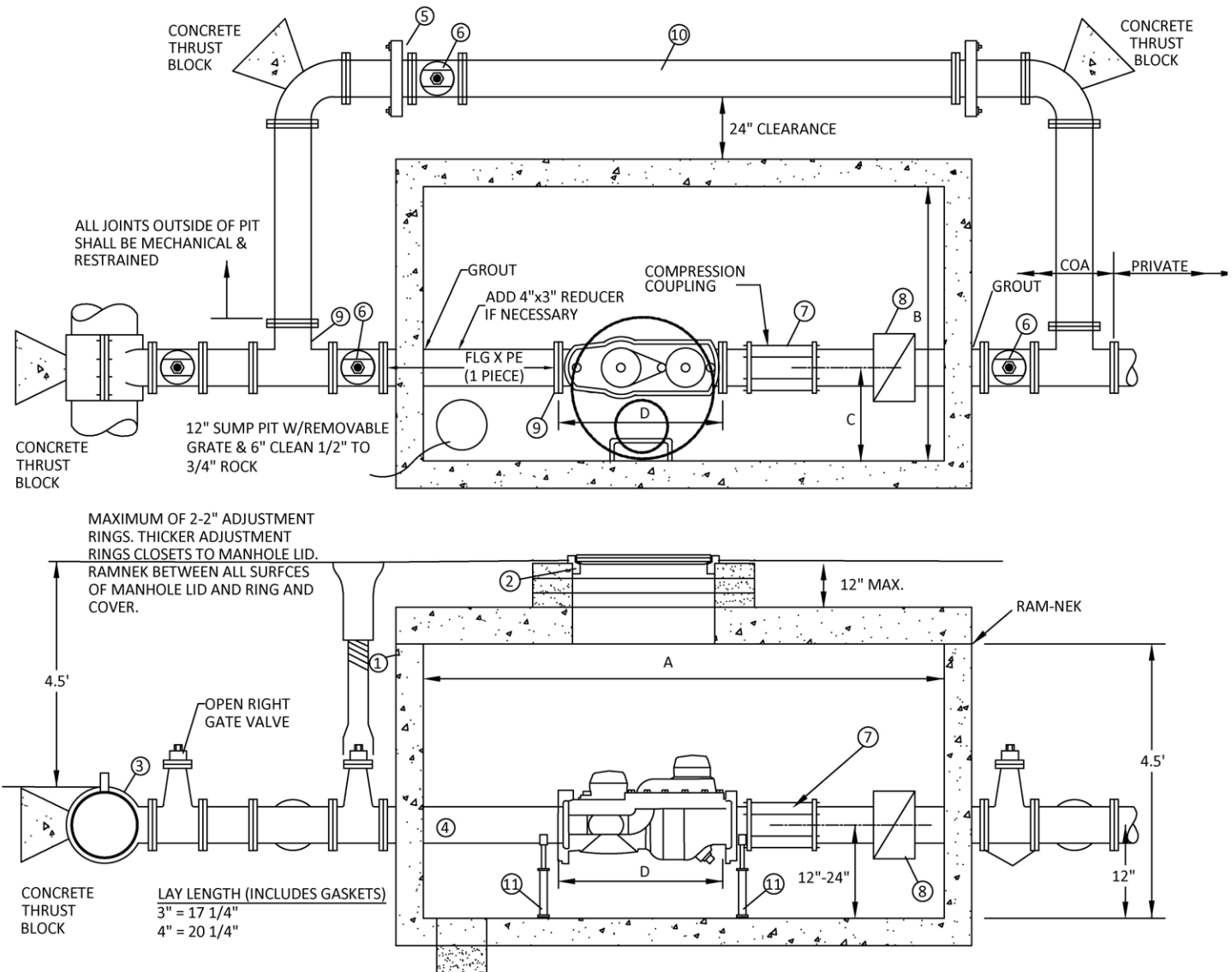
09/25/2019  
DATE  
09/23/2019  
DATE

1 1/2" & 2" DISC METER CUSTOM  
SETTER INSTALLATION FOR  
DOMESTIC SERVICE

1 of 1  
205-1



# STANDARD



## MATERIALS:

1. VAULT-WALL THICKNESS 6", FLOOR THICKNESS 6".
2. SEE DETAIL 206-2 AND 206-3 FOR ADDITIONAL INFORMATION ON RING & COVER.
3. TAPPING TEE & VALVE FURNISHED AND INSTALLED BY THE CITY OF AURORA WATER IN ACCORDANCE WITH LATEST FEE SCHEDULE. (TEE IN MAIN IN LIEU OF TAPPING SLEEVE ALLOWED IF NEW MAIN IS BEING CONSTRUCTED.)
4. ALL PIPING SHALL BE DUCTILE IRON CONFORMING TO AWWA-C151.
5. ALL MECHANICAL JOINTS SHALL BE RESTRAINED.
6. RESILIENT SEAT GATE VALVES (4" MIN.) & VALVE BOX TO BE USED. CLASS 150 CONFORMING TO AWWA-C500.
7. COUPLING SHALL BE COMPRESSION TYPE SMITH-BLAIR, DRESSER OR EQUAL ON OUTLET SIDE.
8. SWING CHECK VALVE FULLY ENCLOSED REQUIRED.
9. FLANGED OR COMPRESSION TYPE FITTINGS ONLY IN METER PIT.
10. BYPASS LINE SHALL BE THE SAME DIAMETER AS THE SERVICE LINE.
11. PIPE STANDS (2 REQUIRED)
12. 3/4" COARSE AGGREGATE (#67) TO BE PLACED 4" THICK BELOW PRECAST

A**	B**	C**	D
72"	60"	26"	*

\* CALL (303) 326-8645 FOR DIMENSIONS  
\*\* MINIMUM DIMENSIONS

## NOTES:

1. TOP STEP TO BE 18"-24" BELOW SURFACE. MANHOLE STEPS TO BE SPACED 12" APART VERTICALLY.
2. PDS INSPECTIONS SHALL INSPECT THE SERVICE LINE PRIOR TO BACKFILLING.
3. METER FURNISHED & INSTALLED BY AURORA WATER.
4. 72" INSIDE DIAMETER ROUND VAULT IS AN ACCEPTABLE ALTERNATIVE. LID TO BE 2 INCHES ABOVE FINISHED GRADE.
5. GATE VALVE ON UPSTREAM SIDE SHOULD BE LOCATED NO FURTHER THAN 3 FEET FROM OUTSIDE OF VAULT.
6. NO SHRUBS ALLOWED WITHIN 5' OF LID.
7. CONCRETE COLLARS ARE REQUIRED WHEN VALVE BOX IS LOCATED WITHIN LANDSCAPED AREA.



AURORA  
WATER

*[Signature]*  
CITY ENGINEER  
*[Signature]*  
AURORA WATER

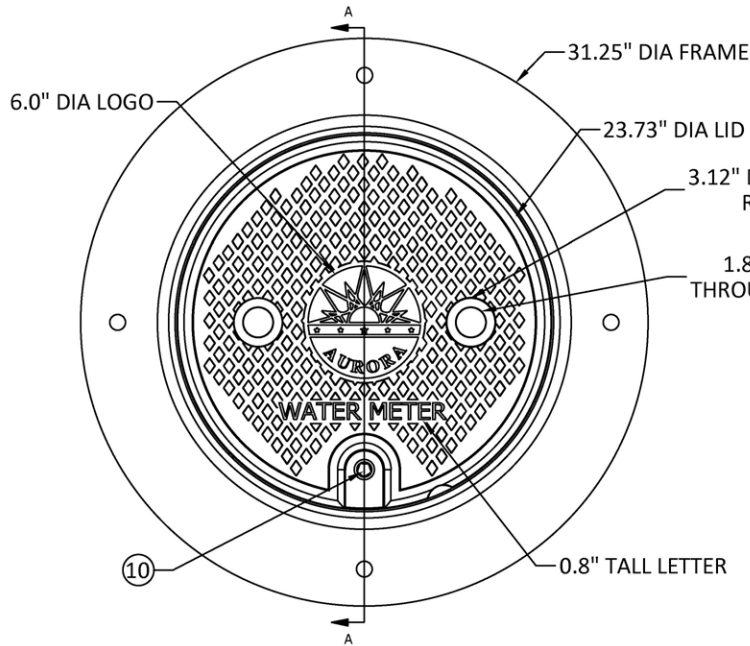
09/25/2019  
DATE  
09/23/2019  
DATE

## METER VAULT INSTALLATION 3", 4" & 6" COMPOUND METER FOR DOMESTIC SERVICE

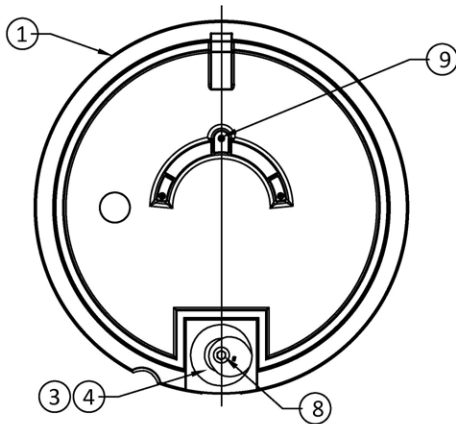
1 of 3

206-1

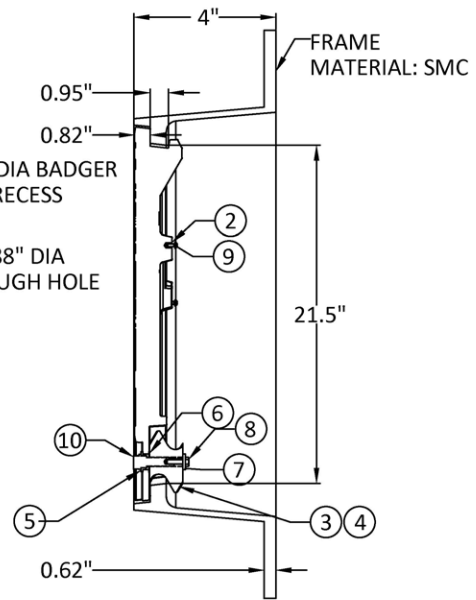
# STANDARD



LID - TOP VIEW



LID - BOTTOM VIEW



SECTION A-A

## MATERIALS:

1. 23.75" x 1" LID (SMC)
2. BRASS THREADED INSERT
3. WORM GEAR, STYLE B (DI)
4. WORM GEAR, STYLE B (UHMWPE)
5. FLANGED SLEEVE, HD
6. BEARING WASHER
7. METRIC PLAIN WASHER
8. HEX CAP SCREWS
9. MACHINE SCREWS
10. BRONZE PENTAGON BOLT

## NOTES:

1. FRAMES SHALL BE COMPOSITE (MAX WEIGHT: 35.21)
2. LIDS ARE REQUIRED TO BE COMPOSITE MATERIAL (MAX WEIGHT: 46.34 lb)
3. SEE APPENDIX B FOR APPROVED MODELS
4. LIDS SHOWN ARE ONLY TO BE ALLOWED FOR COMPOUND METERS (3" AND LARGER)
5. LIDS SHOWN ARE ONLY ALLOWED IN LANDSCAPED AREAS



*Vernon A. Adam*  
CITY ENGINEER  
AURORA WATER

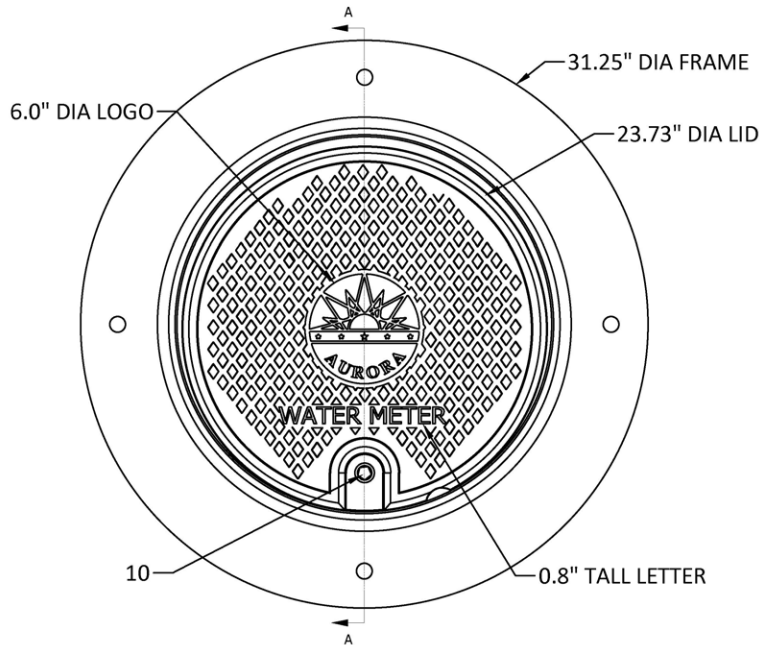
09/25/2019  
DATE  
09/23/2019  
DATE

COMPOSITE METER PIT LID  
FOR COMPOUND METER  
(LANDSCAPE ONLY)

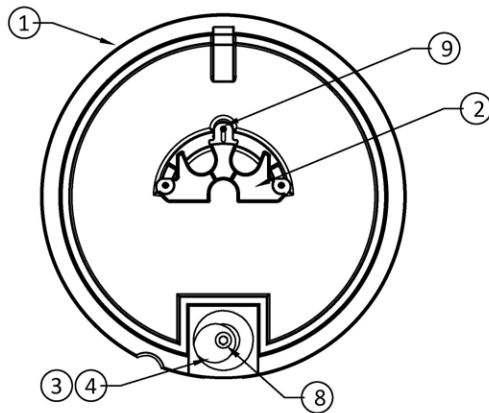
2 of 3

206-2

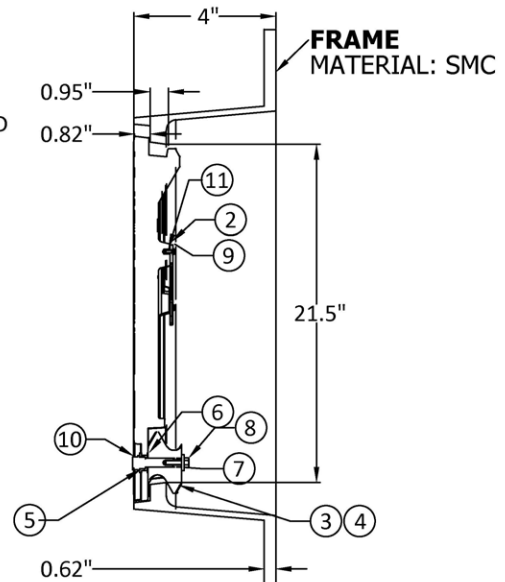
# STANDARD



**LID - TOP VIEW**



**LID - BOTTOM VIEW**



**SECTION A-A**


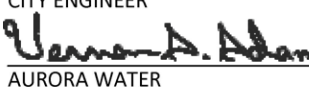
## MATERIALS:

1. 23.75" x 1" LID (SMC)
2. RETAINER PLATE
3. WORM GEAR, STYLE B (DI)
4. WORM GEAR, STYLE B (UHMWPE)
5. FLANGED SLEEVE, HD
6. BEARING WASHER
7. METRIC PLAIN WASHER
8. HEX CAP SCREWS
9. MACHINE SCREW
10. BRONZE PENTAGON BOLT
11. THREADED INSERT

## NOTES:

1. FRAMES SHALL BE COMPOSITE (MAX WEIGHT 35.21)
2. LIDS SHALL BE COMPOSITE (MAX WEIGHT: 46.74)
3. SEE APPENDIX B FOR APPROVED MODELS
4. LIDS SHOWN ARE ONLY TO BE ALLOWED FOR COMPOUND METERS (3" AND LARGER)
5. LIDS SHOWN ARE ONLY ALLOWED IN HARD SURFACE AREAS
6. LIDS SHALL BE HS-20 TRAFFIC RATED



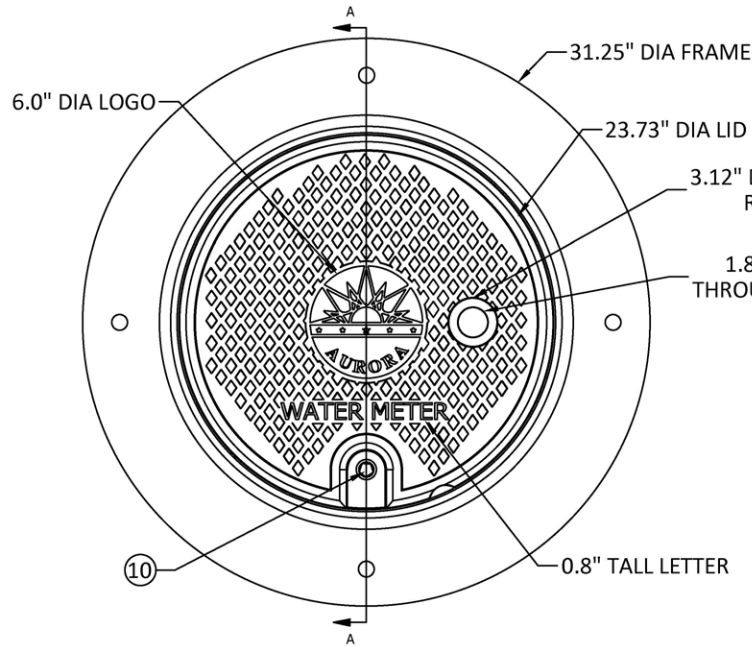
  
 CITY ENGINEER  
 DATE 09/25/2019  
  
 AURORA WATER  
 DATE 09/23/2019

**COMPOSITE METER PIT LID &  
 FRAME FOR COMPOUND  
 METERS (HARDSCAPE ONLY)**

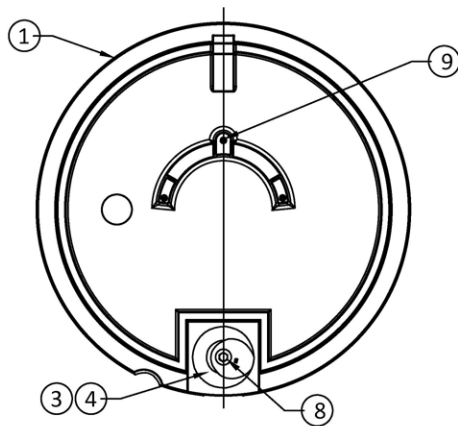
3 of 3

206-3

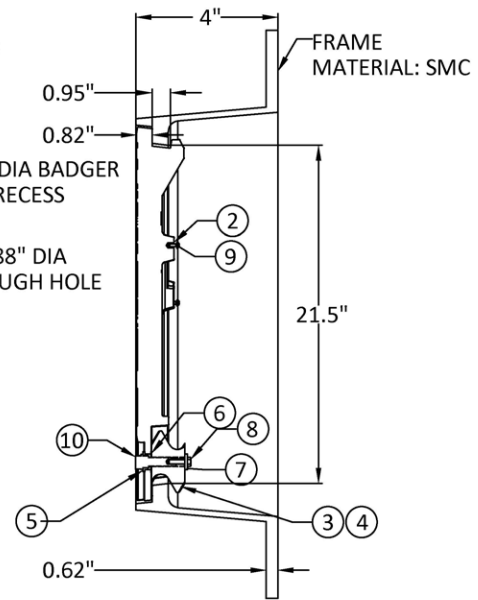
# STANDARD



LID - TOP VIEW



LID - BOTTOM VIEW



SECTION A-A

## MATERIALS:

1. 23.75" x 1" LID (SMC)
2. BRASS THREADED INSERT
3. WORM GEAR, STYLE B (DI)
4. WORM GEAR, STYLE B (UHMWPE)
5. FLANGED SLEEVE, HD
6. BEARING WASHER
7. METRIC PLAIN WASHER
8. HEX CAP SCREWS
9. MACHINE SCREWS
10. BRONZE PENTAGON BOLT

## NOTES:

1. FRAMES SHALL BE COMPOSITE (MAX WEIGHT: 35.21)
2. LIDS ARE REQUIRED TO BE COMPOSITE MATERIAL (MAX WEIGHT: 46.54 lb)
3. SEE APPENDIX B FOR APPROVED MODELS
4. LIDS SHOWN ARE ONLY TO BE ALLOWED FOR 1.5" AND 2" METERS (Disc and Turbine)



*[Signature]*  
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*[Signature]*  
AURORA WATER

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DATE

## COMPOSITE METER PIT LID & FRAME

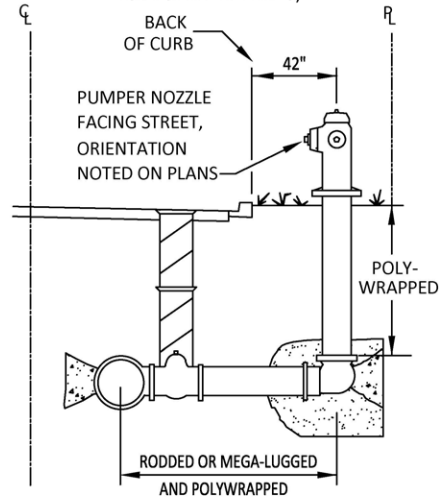
1 of 1

207-1



# STANDARD

\*(SEE SECTION 16.00  
FOR FURTHER DETAILS)



## CROSS SECTION

### FIRE HYDRANT ASSEMBLY

HYDRANT MUST BE  
PLUMB IN ALL  
DIRECTIONS

FINISHED FLANGE  
ELEVATION MUST BE  
2"-6" ABOVE FINAL  
GRADE. ELEVATION SHALL  
BE SHOWN ON PLANS &  
STAKED IN THE FIELD.

2" MIN  
6" MAX

BURY  
LINE

7' MAX.

COVER ROCK WITH APPROVED  
FILTER BLANKET OR 8 MIL  
POLYETHYLENE SHEET PRIOR  
TO PLACING BACKFILL

0.33 CU. YD.  
STABILIZATION  
MATERIAL (SEC. 19.03.1)

FIRE HYDRANT LATERAL

#### NOTES:

1. FIRE HYDRANTS TO BE UNOBSTRUCTED TO THE STREET AND A MINIMUM CLEARANCE OF 5' ON ALL OTHER SIDES.
2. WHEN ADJUSTMENTS ARE REQUIRED TO EXISTING FIRE HYDRANTS IN NO CASE SHALL THE BURY DEPTH EXCEED 7.0 FEET (5.5' BARREL WITH 18" EXTENSION). IF ADJUSTMENTS TO THE FIRE HYDRANT LATERAL ARE REQUIRED, (I.E. VERTICAL BENDS) THEN THE HYDRANT SHALL BE ADJUSTED TO A 5'-6" BURY DEPTH.
3. FOR NEW HYDRANTS, THE MAXIMUM BURY DEPTH IS 5'-6" DEEP.
4. HYDRANTS OLDER THAN 5 YEARS MUST BE REPLACED; LESS THAN 5 YEARS CAN BE RELOCATED.

CONCRETE  
THRUST  
BLOCK  
2.5'wX2.5'h  
X 1.0' THICK

SUPPORT BLOCKING  
FOR LATERALS

UNDISTURBED  
GROUND

5'-6"  
BURY  
DEPTH



AURORA  
WATER

*David A. Rehulfs*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

09/23/2019  
DATE

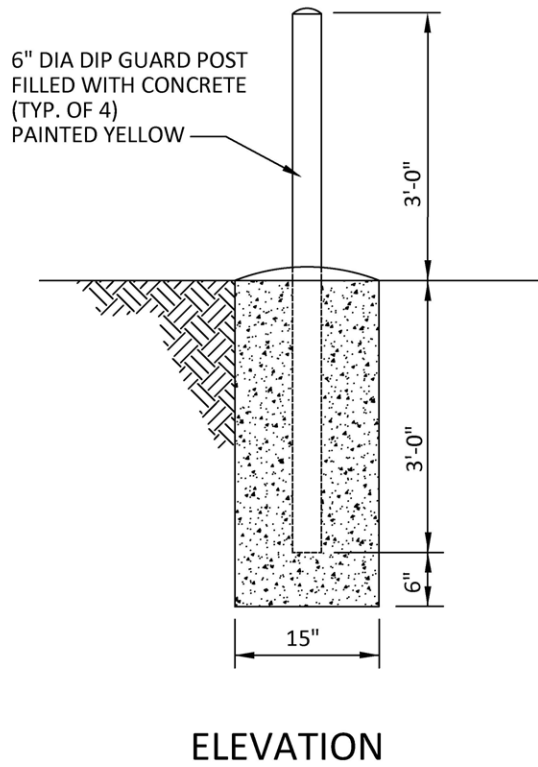
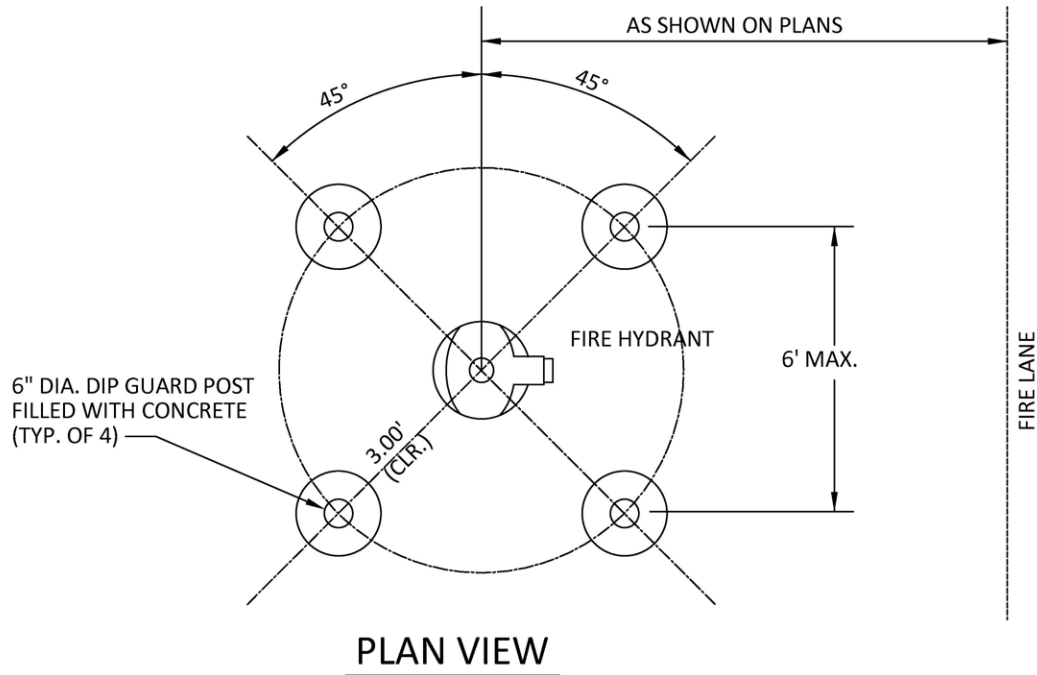
## FIRE HYDRANT ASSEMBLY

1 of 2

208-1



# STANDARD



*Vernon A. Adam*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

09/25/2019  
DATE  
09/23/2019  
DATE

FIRE HYDRANT BOLLARDS

2 of 2  
208-2

## \\AURORA\FILES\DEPT\PUBLIC WORKS\PWD\PWD\DRAW\STANDARD\STANDARD\2019 REVISION\209-1.DWG



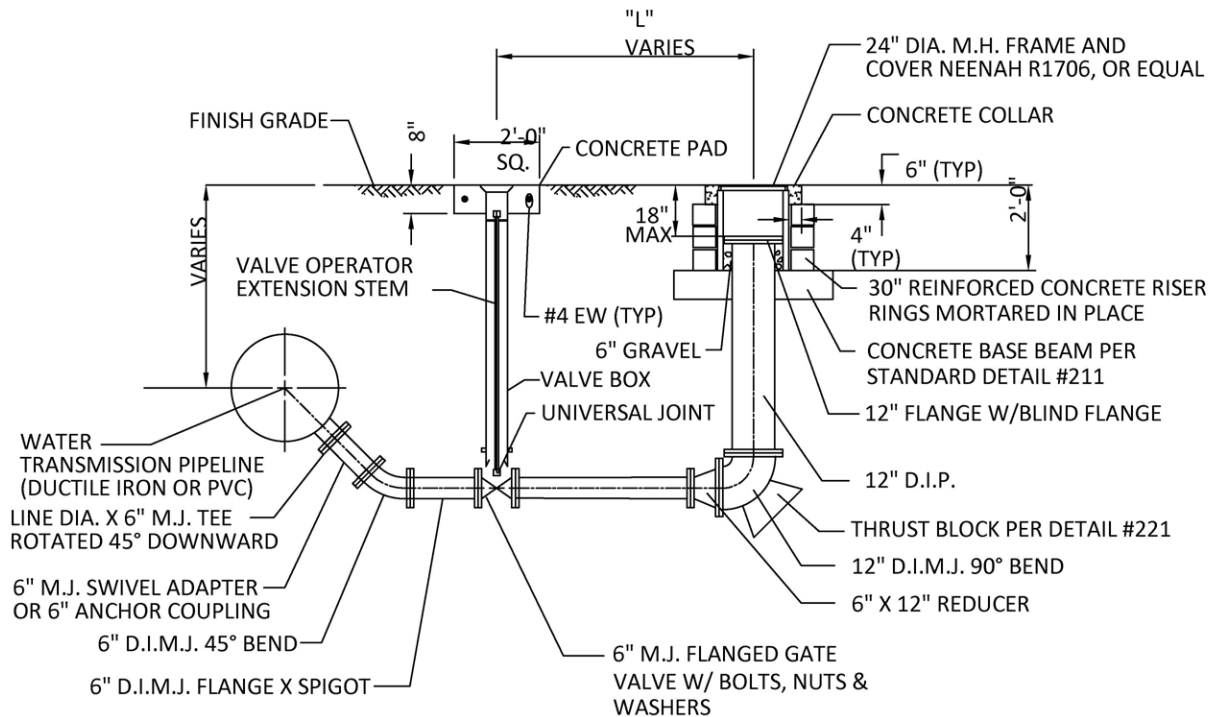
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DATE \_\_\_\_\_

1 of 1

209-1

# STANDARD



## NOTES:

1. ALL BLOW-OFF PIPING SHOWN SHALL BE PRESSURE CLASS 350 D.I.P. AND POLYWRAPPED
2. REF. PLAN AND PROFILE SHEETS FOR BLOWOFF LOCATIONS AND ELEVATIONS.
3. MEG-A-LUG RESTRAINT IS REQUIRED FOR ALL PIPING.
4. CATHODIC PROTECTION SHALL BE PROVIDED BY ATTACHING A 17 lb. ANODE AND TEST SITE (32 LB. ANODE FOR RUNS EXCEEDING 50 FEET) TO THE 6" PIPING BETWEEN THE VALVE AND 90° BEND, PER DETAIL No. 219.
5. IF "L" IS GREATER THAN 20 FEET ON A D.I.P. MAIN, GATE VALVE MUST BE FLANGED WITH INSULATING FLANGE KIT.
6. IF DEPTH OF VALVE IS GREATER THAN OR EQUAL TO 12 FEET, REPLACE VALVE BOX WITH 6 INCH DIP.



*David A. Reckels*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

09/23/2019  
DATE

6" BLOWOFF  
(DUCTILE IRON or PVC)

1 of 2

210-1

## \\AURORA\FILES\DEPT\PUBLIC WORKS\PWD\PWD\STANDARD\UTIL-STD\2019 REVISION\210-2.DWG



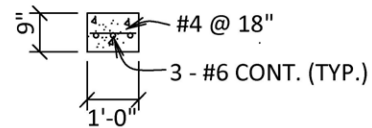
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CITY ENGINEER

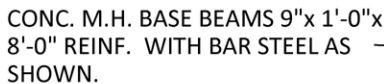
Vernon A. Adam  
AURORA WATER

2 of 2

210-2



### FOOTING DETAIL



- NOTE: USE 2-2" AIR VALVES ON 30" OR SMALLER DUCTILE PIPE

1. TOP 6" IN VAULT SHALL BE CRUSHED ROCK.
2. THE DISTANCE BETWEEN RUNGS, CLEATS, AND STEPS SHALL NOT EXCEED 12 INCHES AND SHALL BE UNIFORM THROUGHOUT THE LENGTH OF THE LADDER.
3. LADDER RUNGS ARE REQUIRED IN PRECAST CONCRETE MANHOLES.

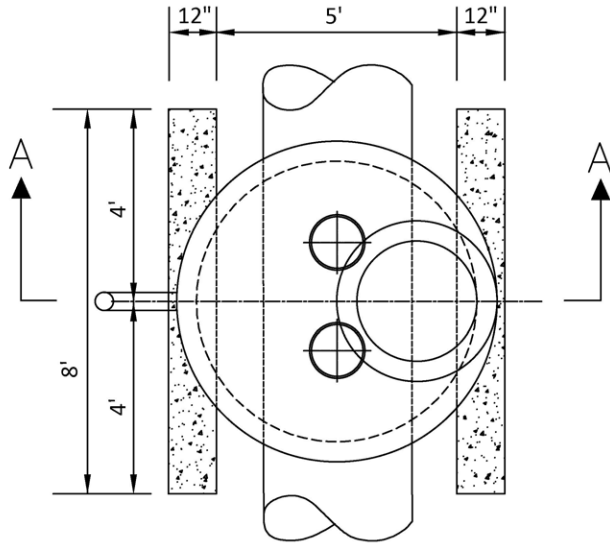
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*[Signature]*  
CITY ENGINEER

Vernon A. Adam  
AURORA WATER

211-1

# STANDARD



**NOTE:**  
USE 2-2" AIR VALVE ASSEMBLY ON 30"  
OR SMALLER DUCTILE IRON PIPE.

2" IP THR'D OUTLET  
(MUELLER #H9968)  
DUCTILE IRON ONLY

2" CORP. STOP  
THR'D INLET, OR  
THR'D NIPPLE  
(BRASS) DUCTILE  
IRON ONLY

90° STREET ELBOW

2" THR'D AIR VALVE

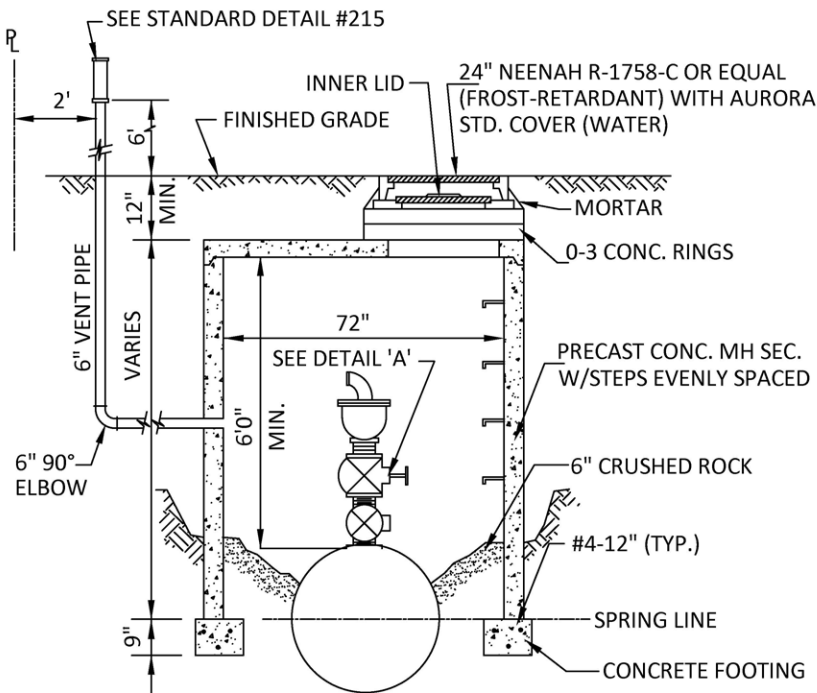
2" IP THR'D NIPPLE  
(BRASS)

2" THR'D BALL VALVE  
WITH HAND LEVER.

EXIST PIPE

STEEL PIPE WELDON'S WILL  
REQUIRE THREAD-O-LETS. PVC  
DIP REQUIRES DOUBLE STRAP  
SADDLE PER APPROVED  
PRODUCTS LIST.

## DETAIL A



## SECTION A-A

### NOTES:

1. TURN DISCHARGE PORT AWAY FROM VALVES AND ACCESS OPENING.
2. 3" AND LARGER AIR VACS BY SPECIAL DESIGN.



*[Signature]*  
CITY ENGINEER

09/25/2019  
DATE

*[Signature]*  
AURORA WATER

09/23/2019  
DATE

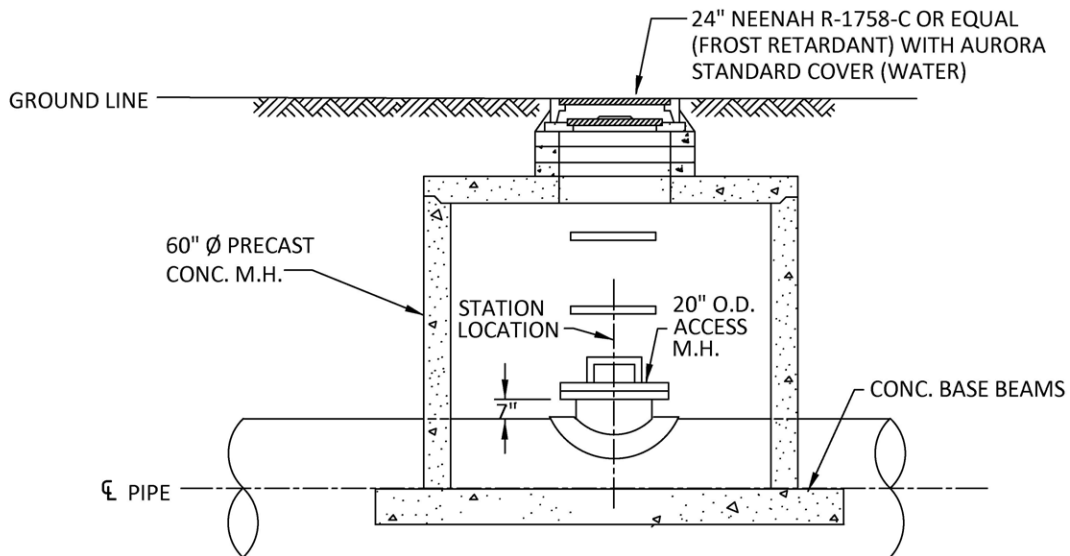
## AIR & VACUUM VALVE INSTALLATION

2 of 3

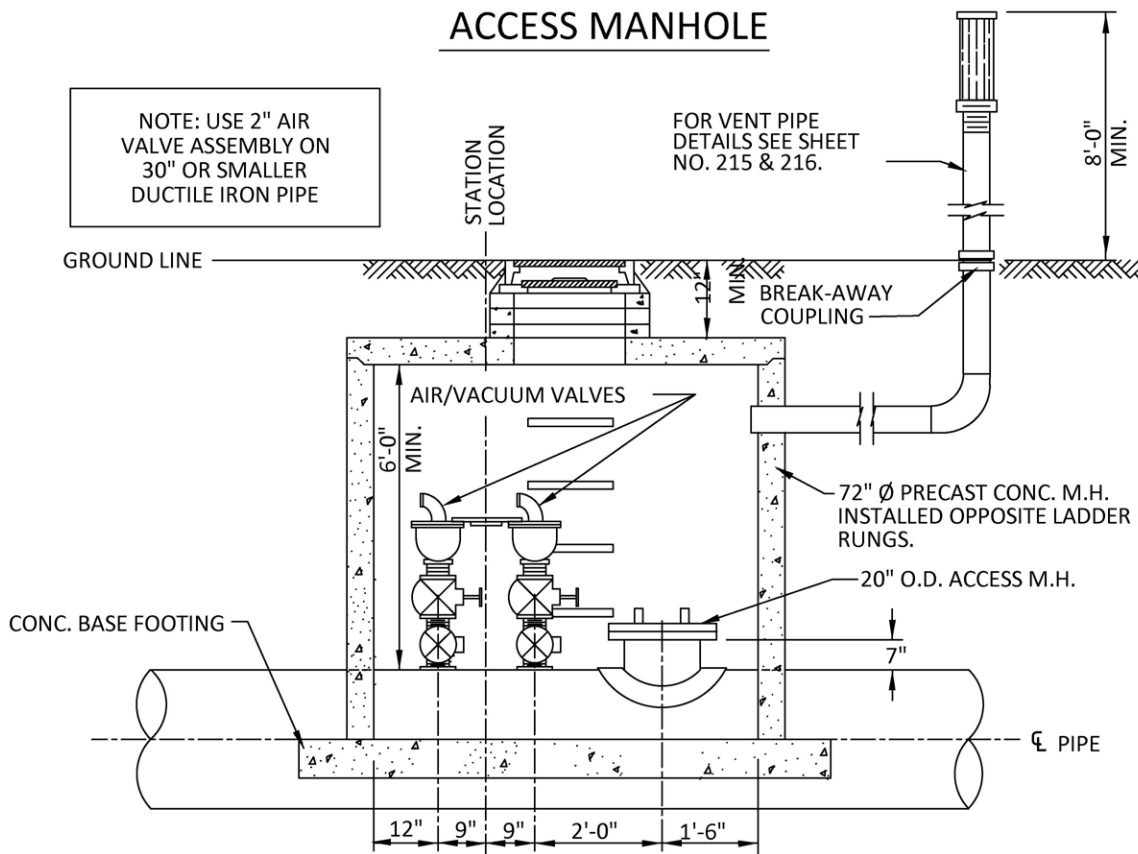
211-2



# STANDARD



## ACCESS MANHOLE



## AIR VALVE ASSEMBLY WITH ACCESS MANHOLE

### NOTE:

1. LADDER RUNGS ARE REQUIRED IN PRECAST MANHOLES. THE DISTANCE BETWEEN RUNGS, CLEATS AND STEPS SHALL NOT EXCEED 12" AND SHALL BE UNIFORM THROUGHOUT THE LENGTH OF THE LADDER.



*David A. Rehefsky*  
CITY ENGINEER

*Vernon A. Adam*  
AURORA WATER

09/25/2019  
DATE

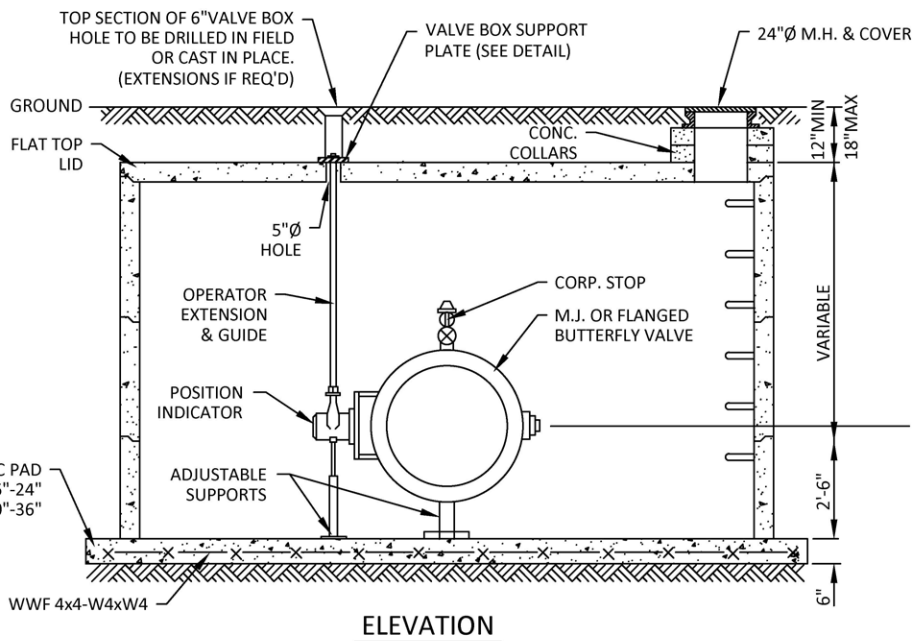
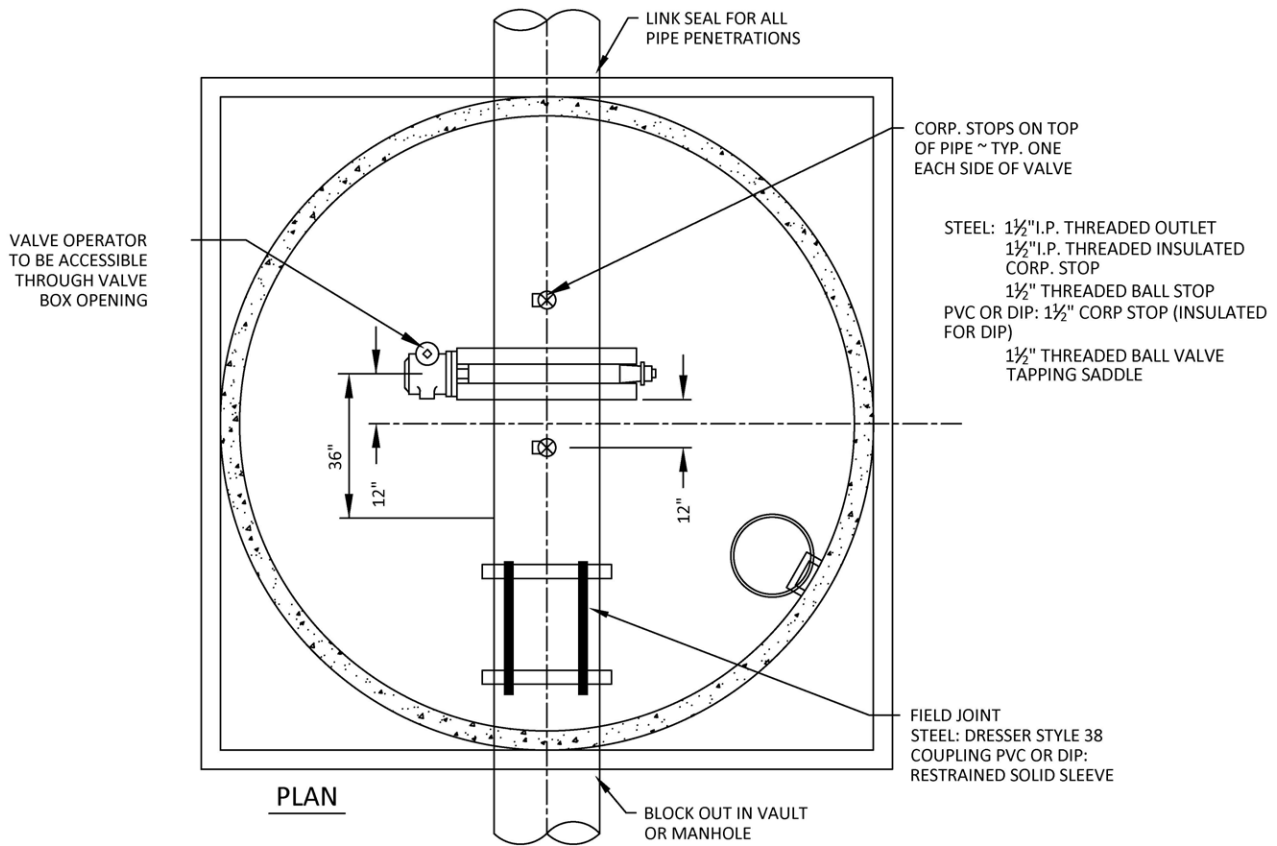
09/23/2019  
DATE

## AIR VALVE ASSEMBLY WITH ACCESS MANHOLE

3 of 3

211-3

# STANDARD



## NOTES:

1. THE DISTANCE BETWEEN RUNGS, CLEATS, AND STEPS SHALL NOT EXCEED 12 INCHES AND SHALL BE UNIFORM THROUGHOUT THE LENGTH OF THE LADDER.
2. 8' I.D. MIN. DIAMETER MANHOLE FOR 16" & 24" VALVES. 9' I.D. MIN. SQUARE VAULT FOR 30" & 36" VALVES.
3. 3/4" COARSE AGGREGATE (#67) TO BE PLACED 4" THICK BELOW PRECAST BASE.



*David A. Ruch*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

09/25/2019  
DATE  
09/23/2019  
DATE

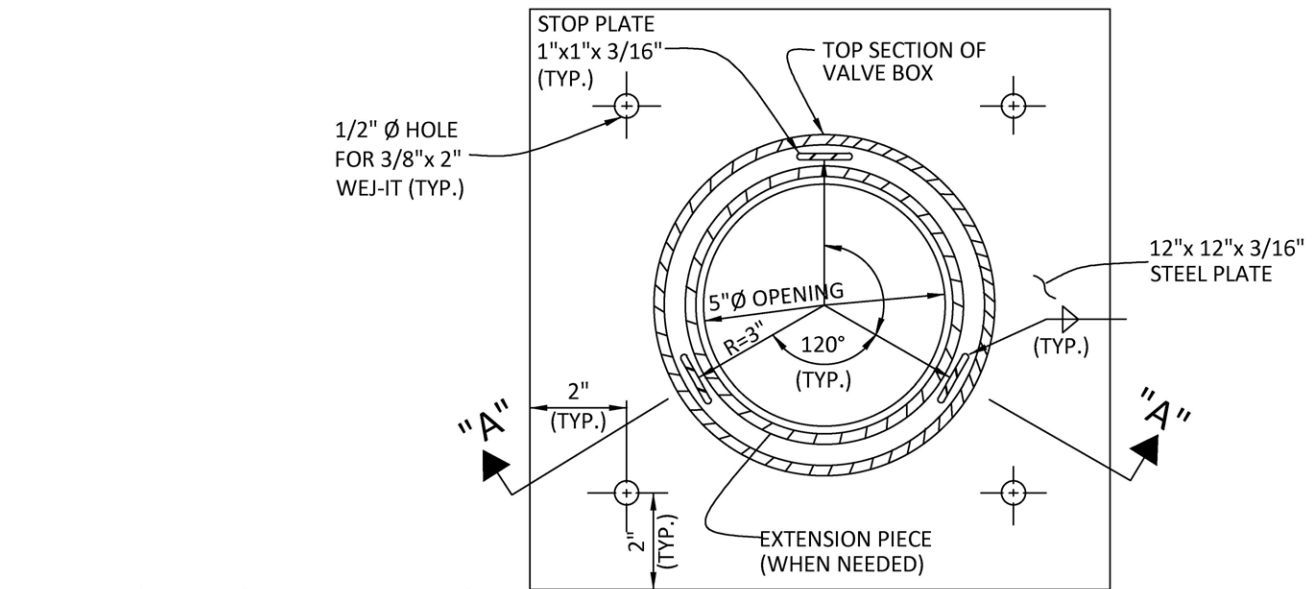
## BUTTERFLY VALVE INSTALLATION

1 of 2

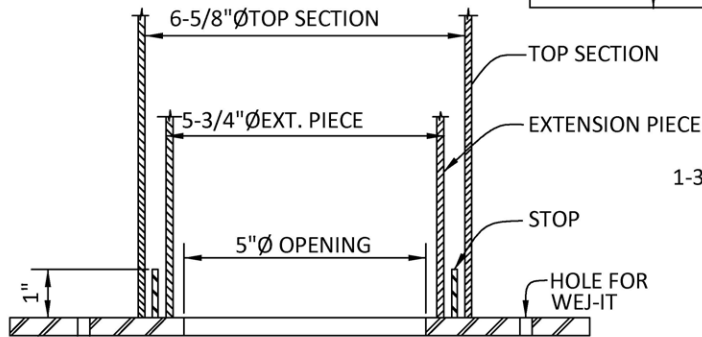
212-1



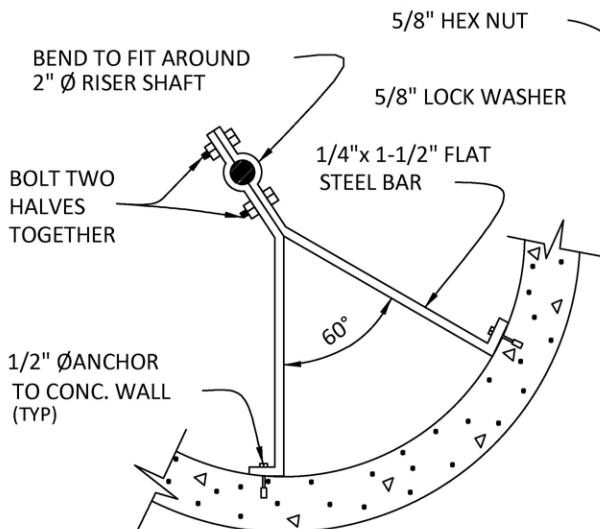
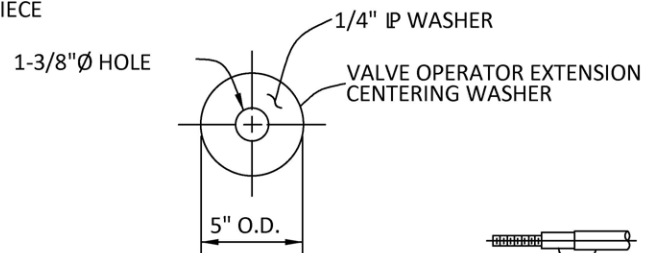
# STANDARD



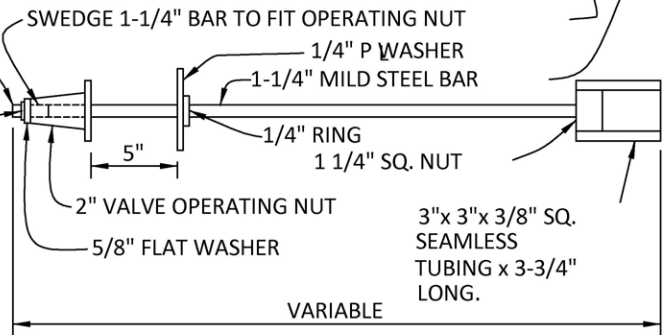
**PLAN**



**SECTION "A"-A"**



**EXTENSION GUIDE**



**VALVE OPERATOR EXTENSION**

UNIVERSAL EXTENSION KEY NOT ALLOWED



*Vernon A. Adam*  
CITY ENGINEER  
AURORA WATER

09/25/2019  
DATE

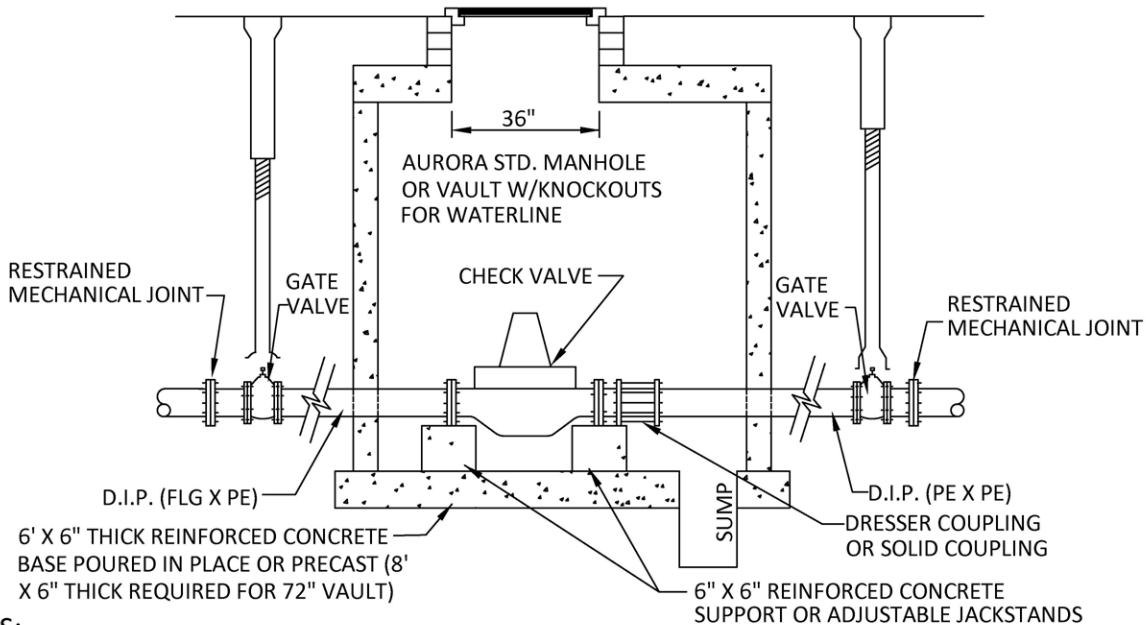
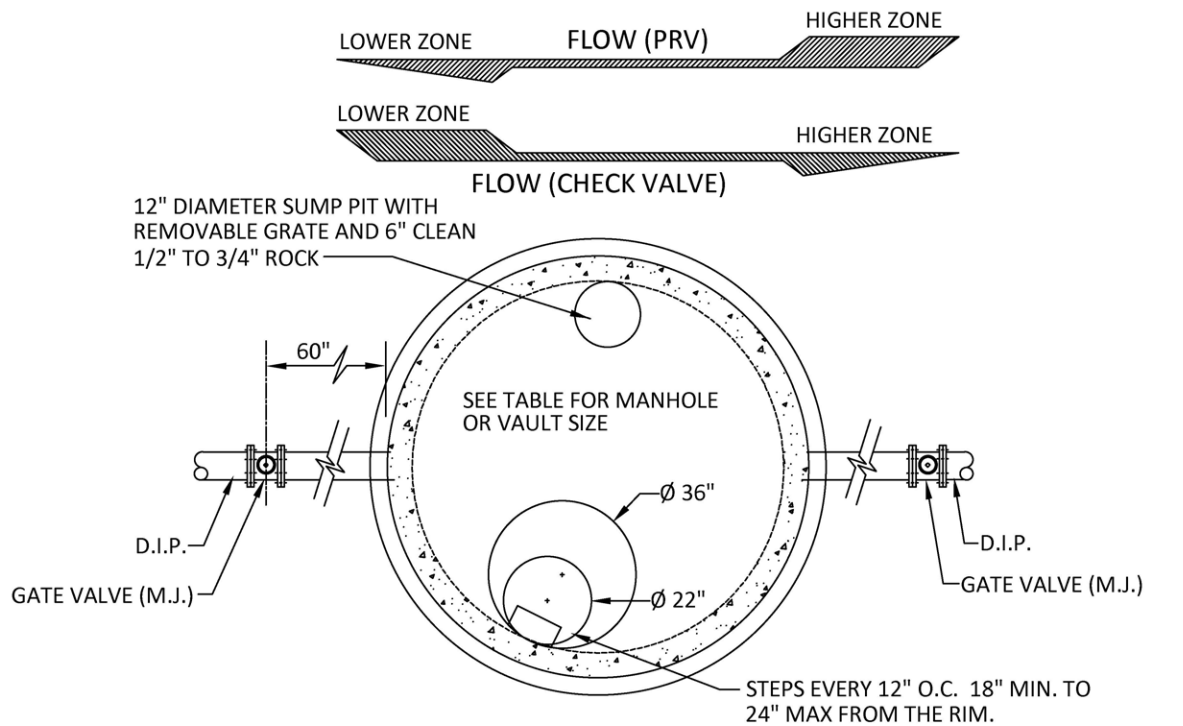
09/23/2019  
DATE

VALVE BOX SUPPORT PLATE  
& VALVE OPERATOR  
EXTENSION GUIDE

2 of 2

212-2

# STANDARD



## NOTES:

1. KNOCKOUTS TO BE GROUTED SHUT.
2. GATE VALVES ARE REQUIRED.
3. RING & COVERS 36"-NEENAH R-1741 WITH 22" INSIDE LID, OR EQUAL, WATER CAST INTO LID, 2" ABOVE FINISHED GRADE (FLUSH IF IN PAVEMENT).
4. SEE SECTION 20.00 FOR COATING REQUIREMENTS.
5. 3/4" COURSE AGGREGATE (#67) TO BE PLACED BELOW PRECAST BASE.

CHECK VALVE SIZE	MANHOLE/VAULT DIA.
6" TO 12"	72"
LARGER THAN 12"	SPECIAL DESIGN



*David A. Reck*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

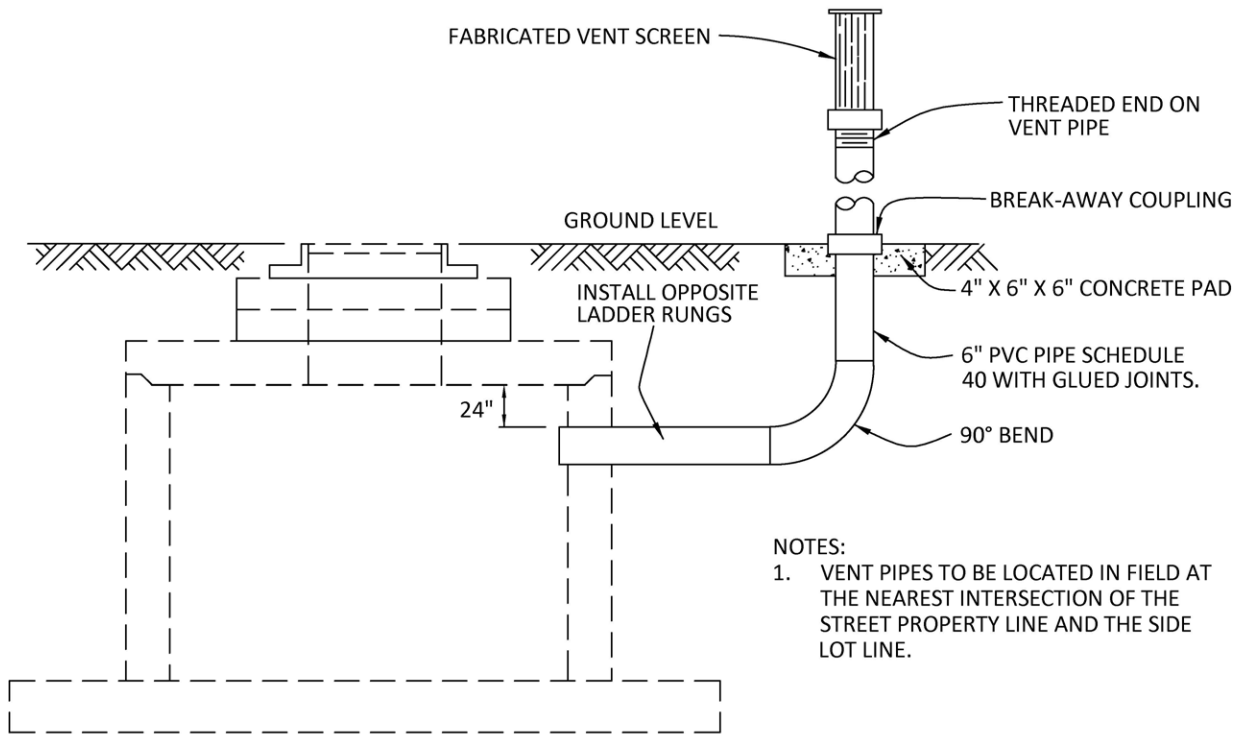
09/25/2019  
DATE  
09/23/2019  
DATE

PRV or CHECK VALVE STATION

1 of 1

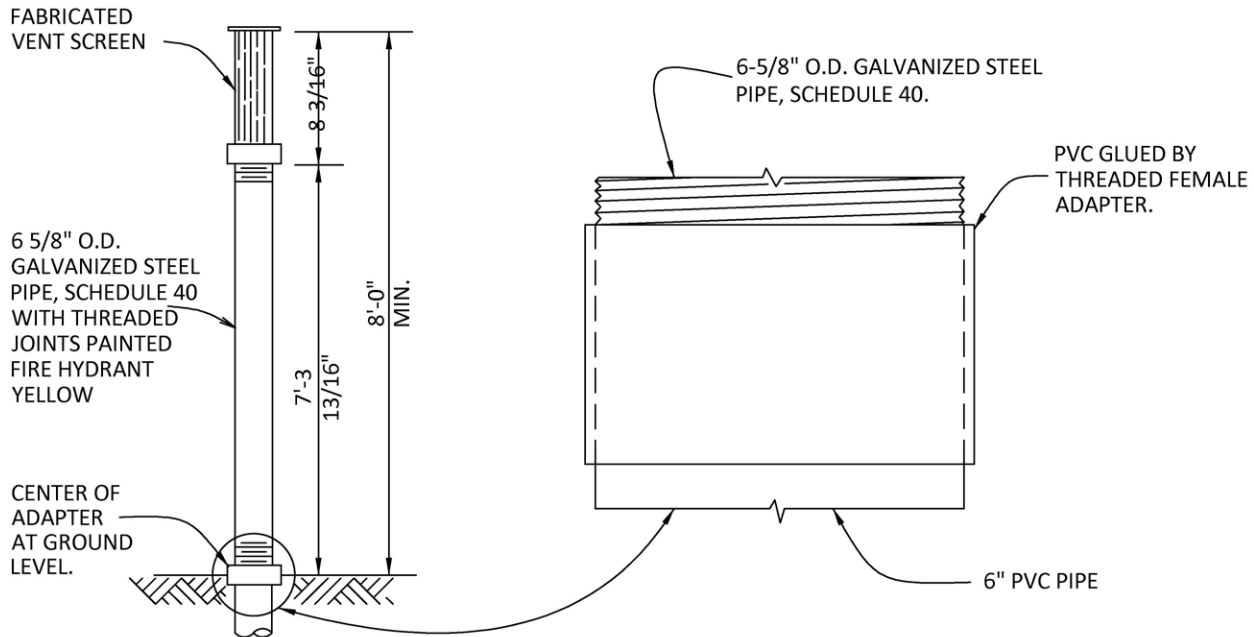
213-1

# STANDARD




- NOTES:
1. VENT PIPES TO BE LOCATED IN FIELD AT THE NEAREST INTERSECTION OF THE STREET PROPERTY LINE AND THE SIDE LOT LINE.

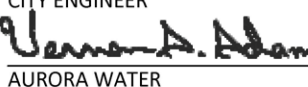
## VENT PIPE INSTALLATION



## VENT PIPE AND BREAK-AWAY COUPLING DETAILS



  
 CITY ENGINEER  
 09/25/2019  
 DATE

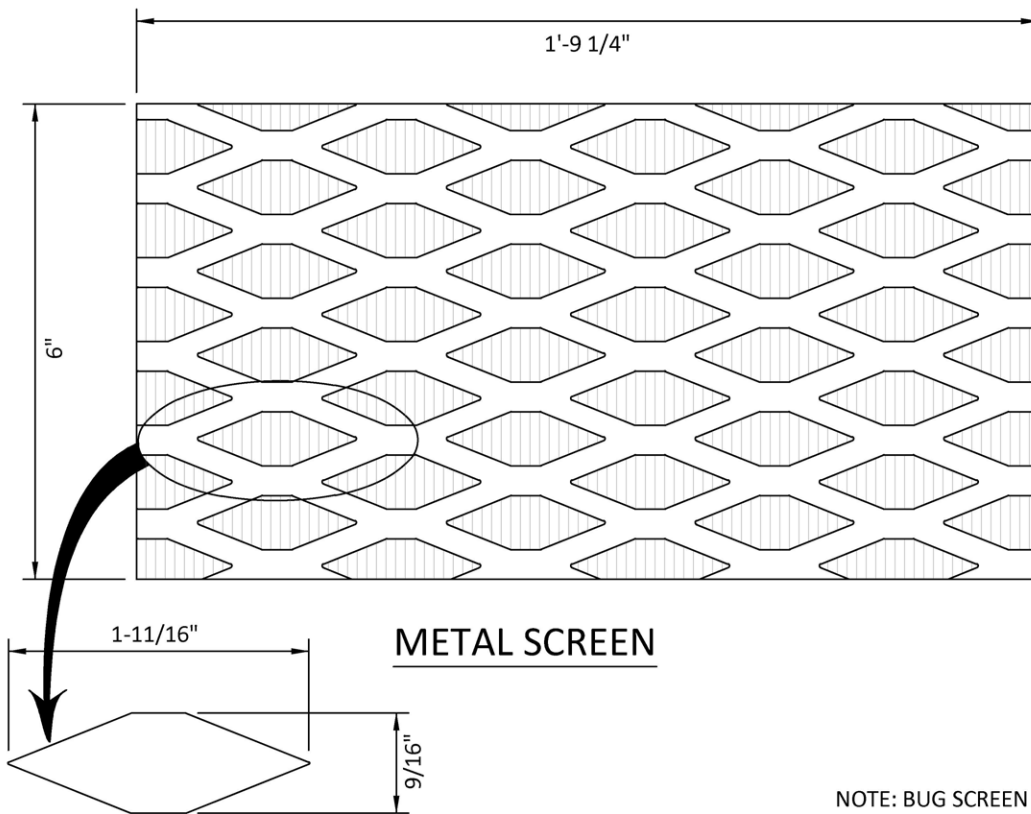
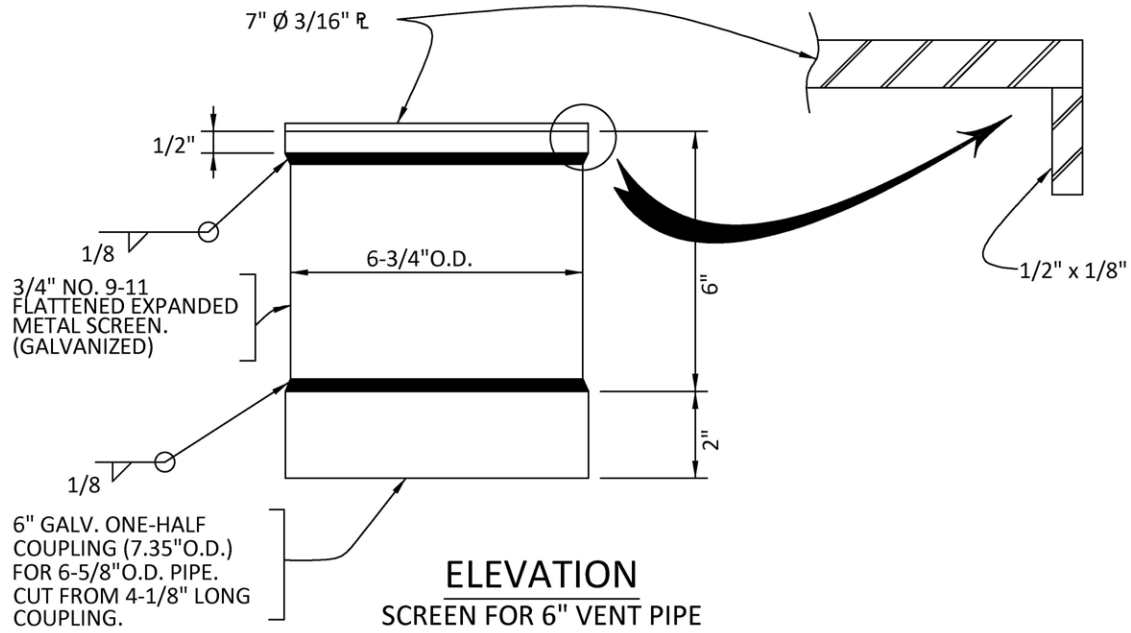
  
 AURORA WATER  
 09/23/2019  
 DATE

## VENT PIPE INSTALLATION DETAILS

1 of 1

214-1

# STANDARD



NOTE: BUG SCREEN TO BE INSTALLED  
ON INTERIOR OF METAL SCREEN.



*David A. Rebeck*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

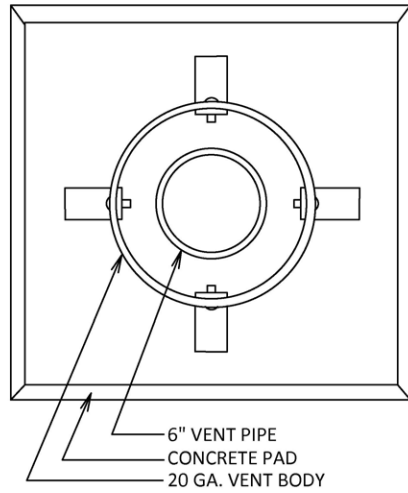
09/23/2019  
DATE

6" DIAMETER  
VENT PIPE SCREEN

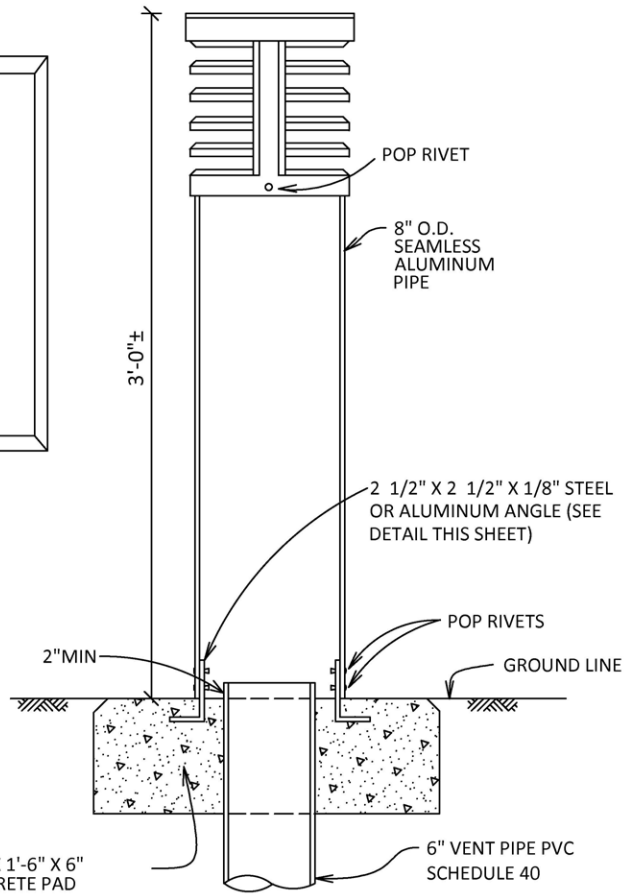
1 of 1

215-1

# STANDARD

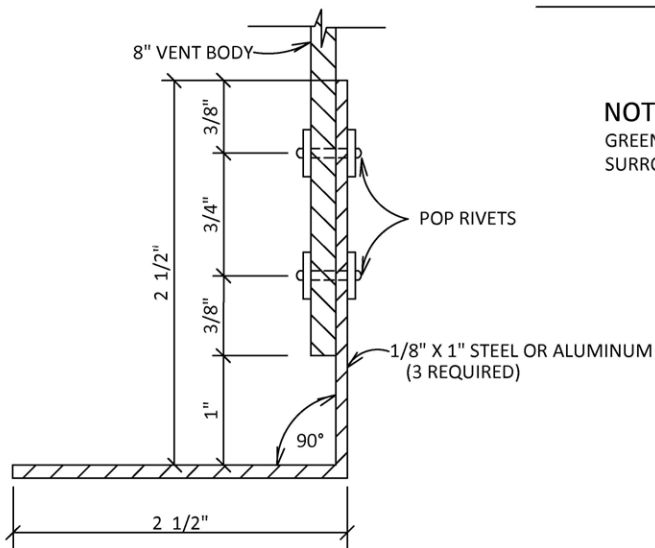


BASE DETAIL



ROUND VENT SCREEN

NOTE: COLOR SHALL BE OLIVE GREEN OR FLAT BLACK TO MATCH SURROUNDINGS.



STEEL OR ALUMINUM ANGLE DETAIL



AURORA  
WATER

*David A. Reilly*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

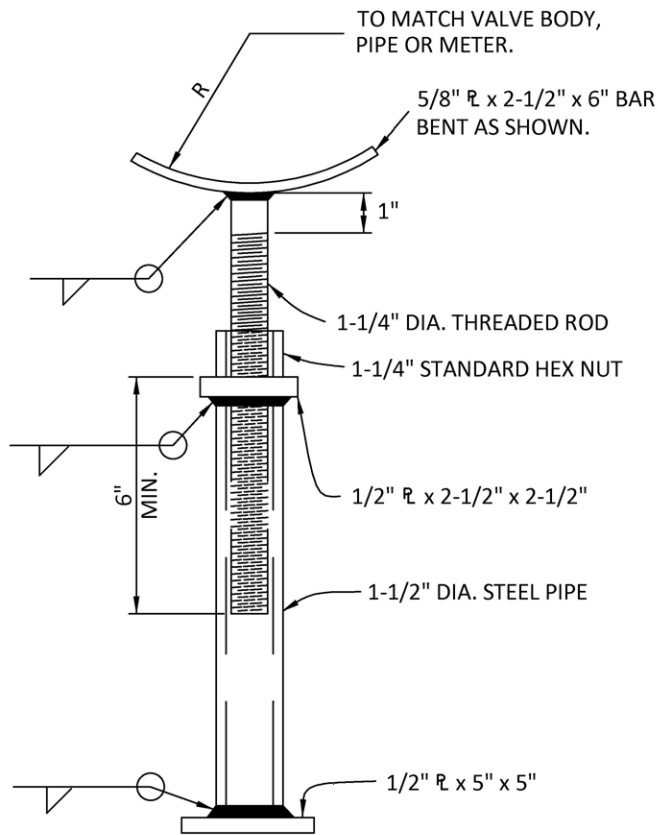
09/23/2019  
DATE

RESIDENTIAL VENT  
ASSEMBLY

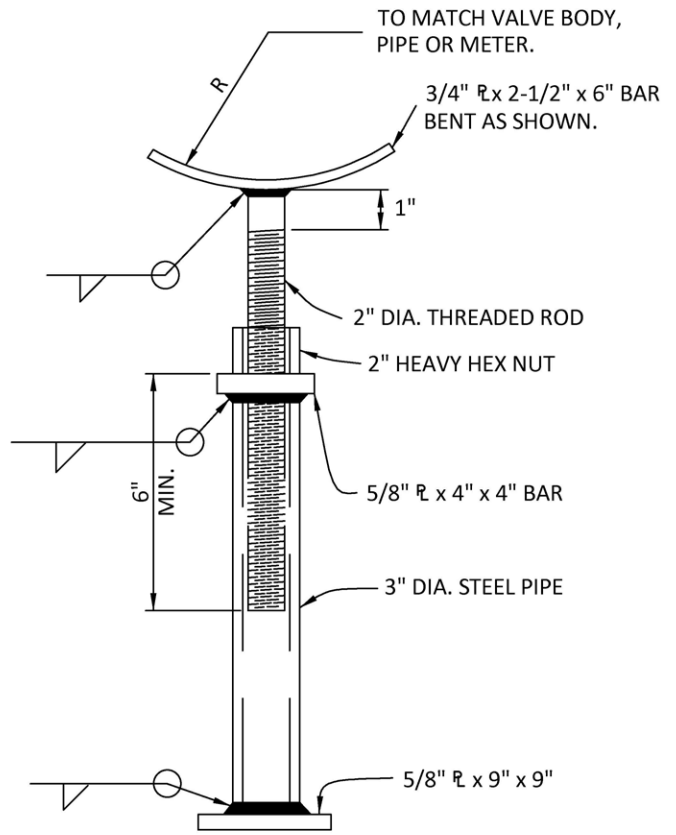
1 of 1

216-1

# STANDARD



**ADJUSTABLE-SUPPORT  
(STANDARD)**



**ADJUSTABLE-SUPPORT  
(HEAVY DUTY)**



*David A. Rehder*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

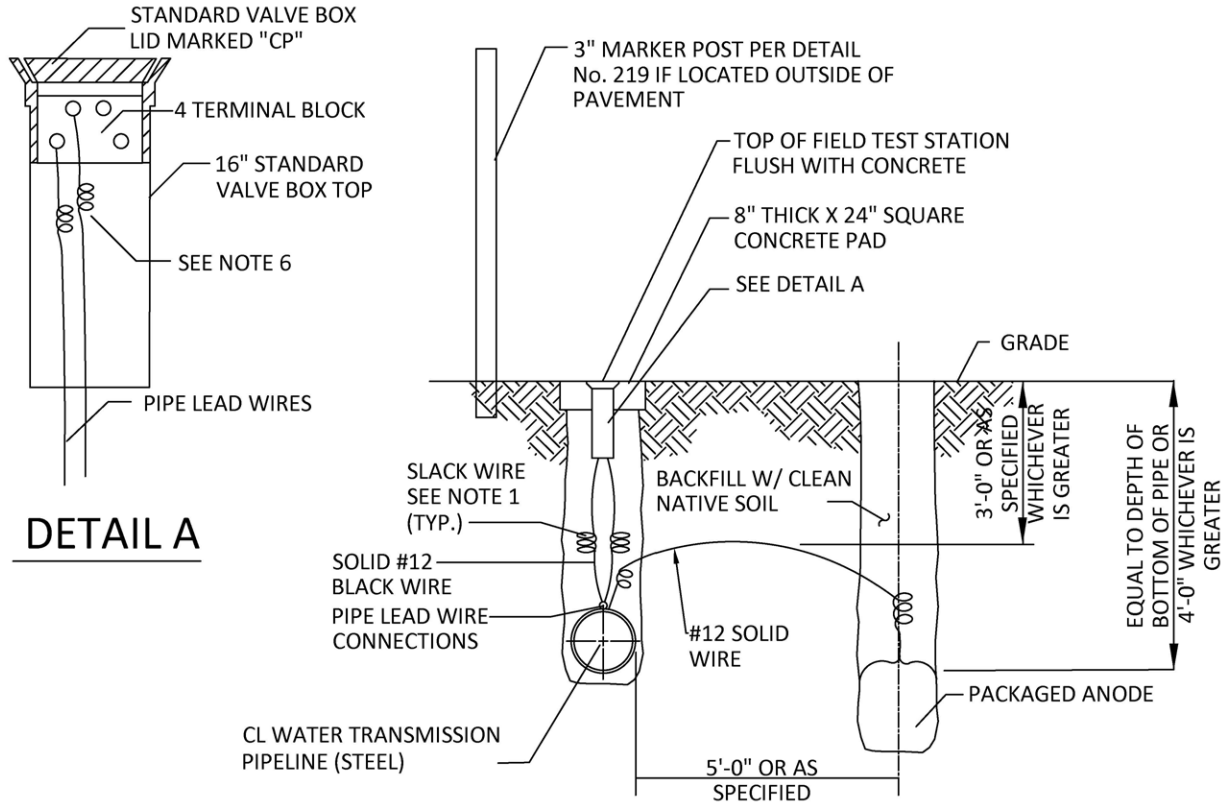
09/25/2019  
DATE  
09/23/2019  
DATE

**ADJUSTABLE STEEL PIPE  
VALVE SUPPORT**

1 of 1  
**217-1**



# STANDARD



## NOTES:

1. ALL LEAD WIRES BURIED IN THE EARTH ABOVE THE PIPE AND ABOVE THE ANODE SHALL BE INSTALLED WITH A MINIMUM OF 18" SLACK TO PREVENT STRESSING OF WIRE OR DIMINISHING THE SLACK REQUIRED IN THE TEST STATION VAULT BECAUSE OF BACKFILL SETTLEMENT.
2. PIPE LEAD WIRES SHALL BE ATTACHED APPROXIMATELY 12" APART ON THE TOP CENTERLINE OF THE PIPE.
3. AT LEAST 5 GALLONS OF WATER SHALL BE POURED OVER THE ANODE BEFORE BACKFILLING.
4. PERMANENT, LEGIBLE IDENTIFICATION MARKERS SHALL BE ATTACHED TO EACH LEAD WIRE IN THE FIELD TEST STATION.
5. ALL MATERIALS AND INSTALLATION SHALL BE AS SPECIFIED.
6. LEAD WIRES INSIDE THE TEST STATION VAULT SHALL BE PROVIDED WITH SUFFICIENT SLACK TO LIFT THE TERMINAL BOARD A MINIMUM OF 12" ABOVE THE VAULT TO ALLOW ACCESS TO THE CONNECTIONS, YET ALLOW THE TERMINAL BOARD AND LID TO BE INSTALLED IN THE VAULT WITHOUT BINDING ON THE SLACK WIRES.

## SACRIFICIAL ANODE INSTALLATION W/ BELOW GROUND FIELD TEST STATION



*David A. Reck*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

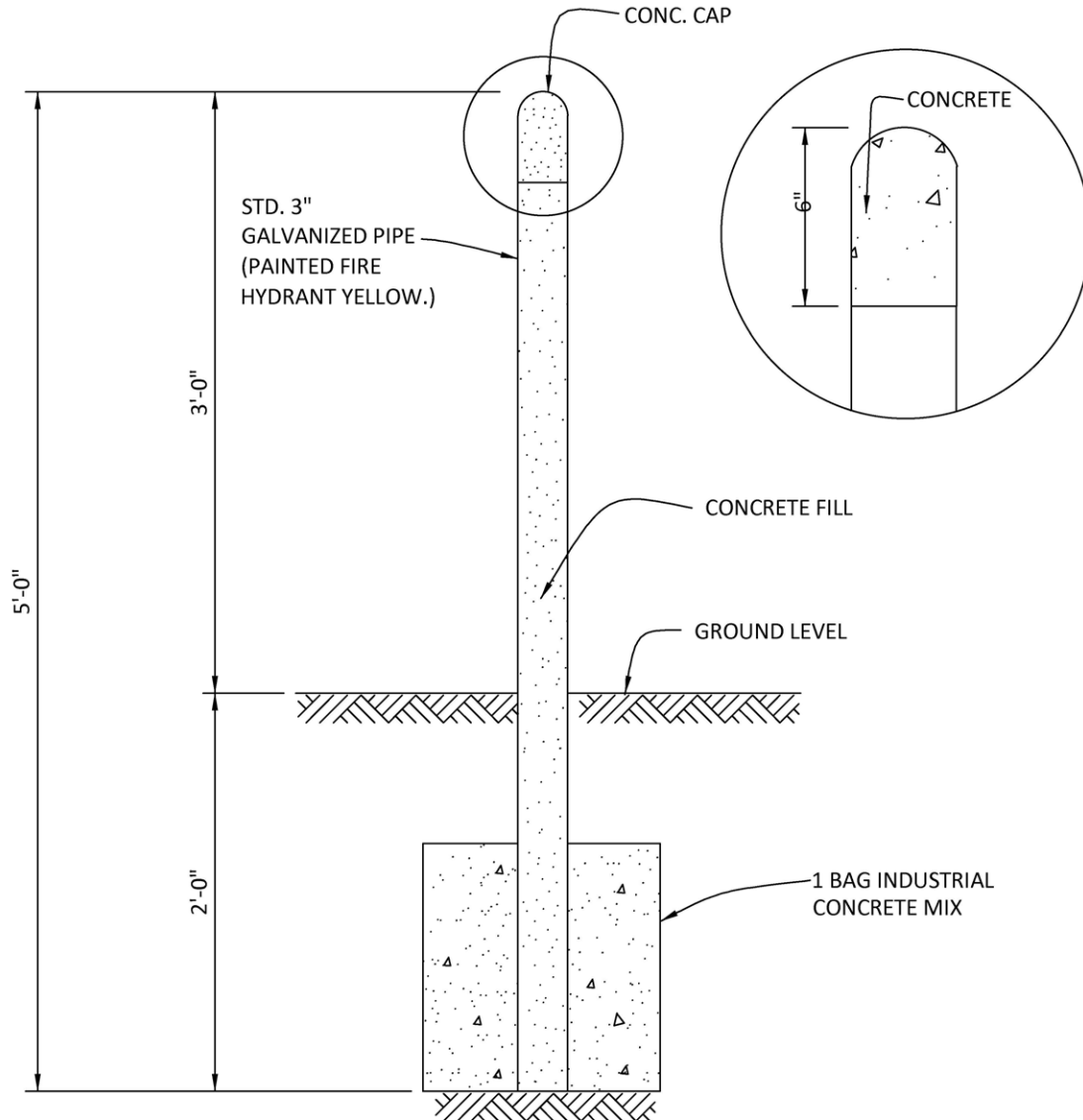
09/23/2019  
DATE

## SACRIFICIAL ANODE INSTALLATION

1 of 1

218-1

# STANDARD



NOTE:  
VALVE BOXES LOCATED OUTSIDE OF PAVEMENT SHALL BE PROVIDED AN 18"  
SQUARE BY 4" DEEP CONCRETE COLLAR.

IDENTIFICATION MARKS ON POSTS SHALL BE 3" DIA. CIRCLES BROKEN IN VERTICAL CENTER (C) POINTING TO APPURTENANCE, WITH 1" STENCILS INSIDE CIRCLE INDICATING TYPE OF APPURTENANCE (MH, 12" GATE VALVE, ETC.) AND THE DISTANCE IN FEET AND INCHES FROM POST.

MARKER POSTS SHALL BE LOCATED NO FURTHER THAN 3 FEET FROM THE APPURTENANCE.



*David A. Ruch*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

09/23/2019  
DATE

REFERENCE POST  
TYPICAL DETAIL

1 of 1

219-1

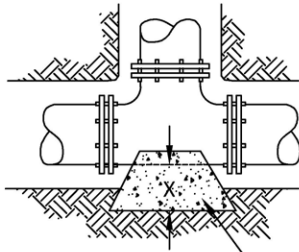


# STANDARD

## BEARING THRUST BLOCKS

MINIMUM BEARING SURFACE AREA ( $A_b$ )  
(IN SQUARE FEET)

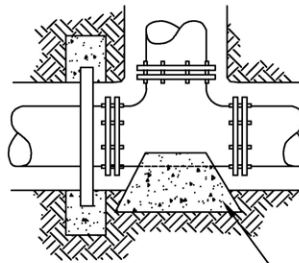
(BASED ON A MINIMUM SOIL  
BEARING CAPACITY OF 2000PSF)



MAY BE REQUIRED  
FOR WET TAP AS  
WELL (SEE NOTE 3)

SIZE OF PIPE DIA	BENDS				TEE OR DEAD END
	11 1/4°	22 1/2°	45°	90°	
6"	1.0	1.5	3.0	5.3	4.0
8"	1.5	2.5	5.0	9.5	6.5
12"	3.0	5.5	10.5	19.5	14.0
16"	4.0	7.0	14.0	25.5	18.0
24"	8.0	15.5	30.0	56.0	40.0

## LENGTH OF TIED PIPE (ft)

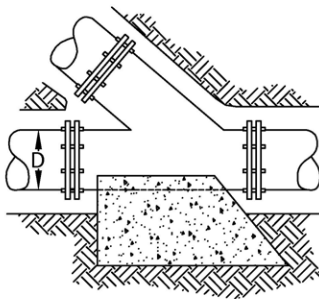


REQUIRED FOR  
WET TAP

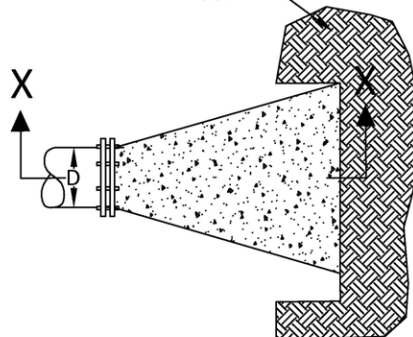
SIZE OF PIPE DIA	HORIZONTAL BENDS				TEE OR DEAD END
	11 1/4°	22 1/2°	45°	90°	
6"	4.0	8.0	17.0	42.0	55.0
8"	5.0	11.0	23.0	54.0	73.0
12"	8.0	16.0	33.0	79.0	106.0
16"	10.0	20.0	43.0	103.0	140.0
24"	15.0	30.0	62.0	149.0	207.0

### NOTES:

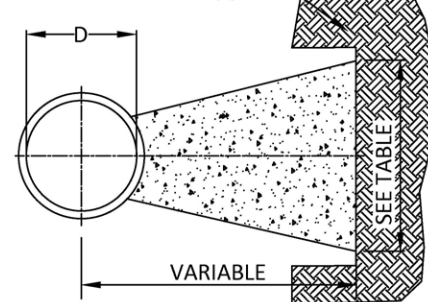
1. ALL METAL SHALL BE WRAPPED IN POLYETHYLENE IN ACCORDANCE WITH THESE SPECIFICATIONS.
2. LARGE DIAMETER LINES WILL REQUIRE ENGINEERING DESIGN AND CALCULATIONS SUBMITTED AND APPROVED. LARGER THAN 24" BY DESIGN.
3. IF THE BRANCH OF A TEE OR WET-TAP IS LESS THAN ONE HALF THE DIAMETER OF THE MAIN, THRUST BLOCK IS NOT REQUIRED.



UNDISTURBED  
SOIL



UNDISTURBED  
SOIL



SECTION X-X



AURORA  
WATER

*[Signature]*  
CITY ENGINEER

09/25/2019  
DATE

*[Signature]*  
AURORA WATER

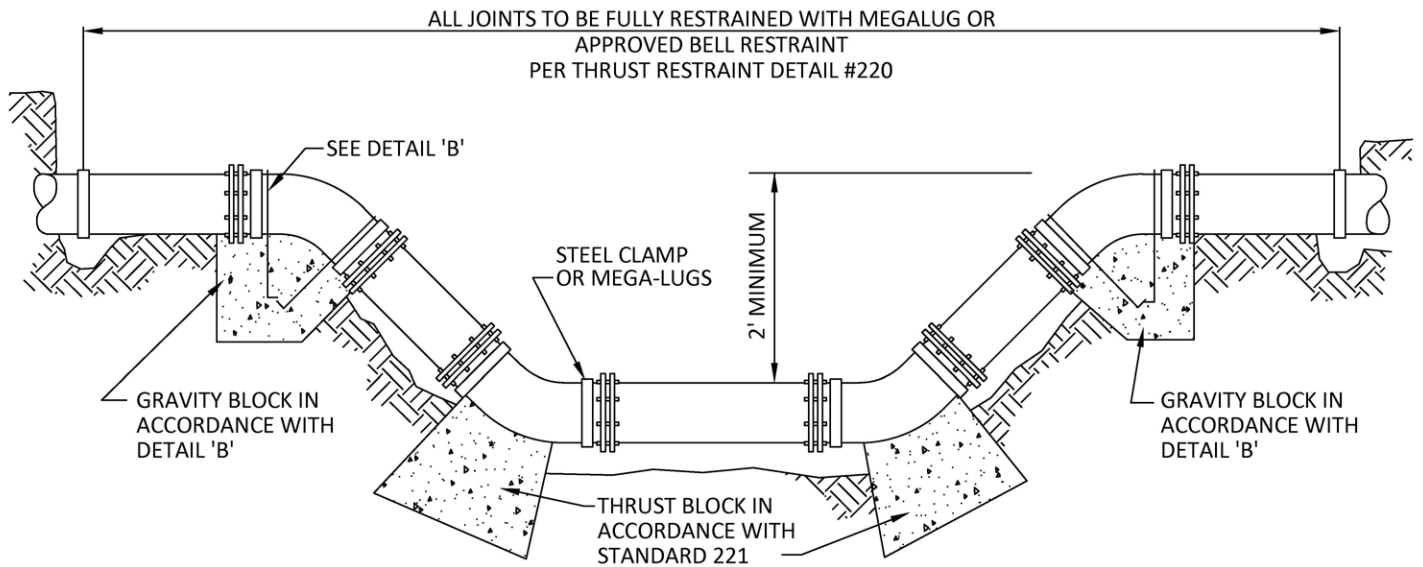
09/23/2019  
DATE

THRUST BLOCK LOCATION and  
BEARING AREAS & VOLUMES

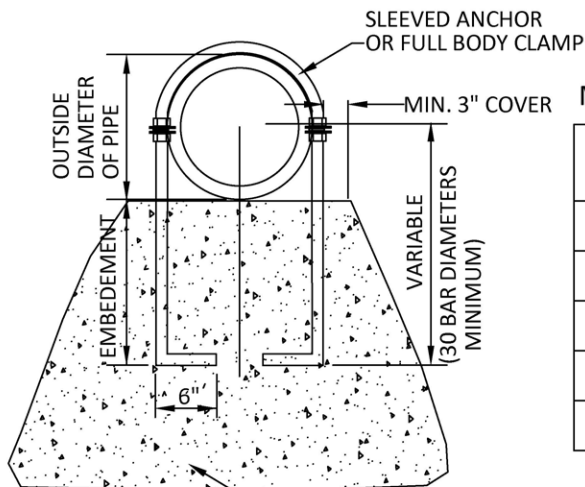
1 of 1

220-1

# STANDARD



## WATERLINE LOWERING DETAIL



### GRAVITY BLOCKS

#### MINIMUM VOLUME (IN CUBIC FEET)

SIZE OF PIPE	BENDS		
	11 1/4°	22 1/2°	45°
6"	10.5	20.5	40.0
8"	17.5	35.0	68.0
12"	37.0	74.0	145.0
16"	48.5	96.0	189.0
24"	106.0	211.0	414.0

LARGER THAN 24" BY SPECIAL DESIGN

### DETAIL B

#### NOTES:

1. VERTICAL 90° BENDS ARE NOT ALLOWED.
2. ALL LINES 12" AND LARGER WILL REQUIRE BODY CLAMPS (NATIONAL PIPE HANGER HEAVY TWO-BOLT PIPE CLAMP OR APPROVED EQUAL) APPROPRIATELY SIZED ALL-THREAD AND DOUBLE NUT.
3. THERE SHALL BE A MINIMUM CLEARANCE OF 24" BETWEEN WATERLINE AND ANY NEW CONSTRUCTION.
4. ALL JOINTS SHALL BE RESTRAINED PER DETAIL 220-1.
5. ANCHORS SHALL BE SLEEVED TO PREVENT CORROSION OF THE PIPE AND/OR BAR. THIS COULD INCLUDE, BUT NOT LIMITED TO, REINFORCED GARDEN HOSE, CURVED FIBERGLASS BOARD, ETC.
6. CONCRETE STRENGTH TO BE AT LEAST 3,000 PSI AT 28 DAYS, AND YIELD STRENGTH OF ANCHOR ROD (REBAR) TO BE 60,000 PSI.



AURORA  
WATER

*David A. Rehder*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

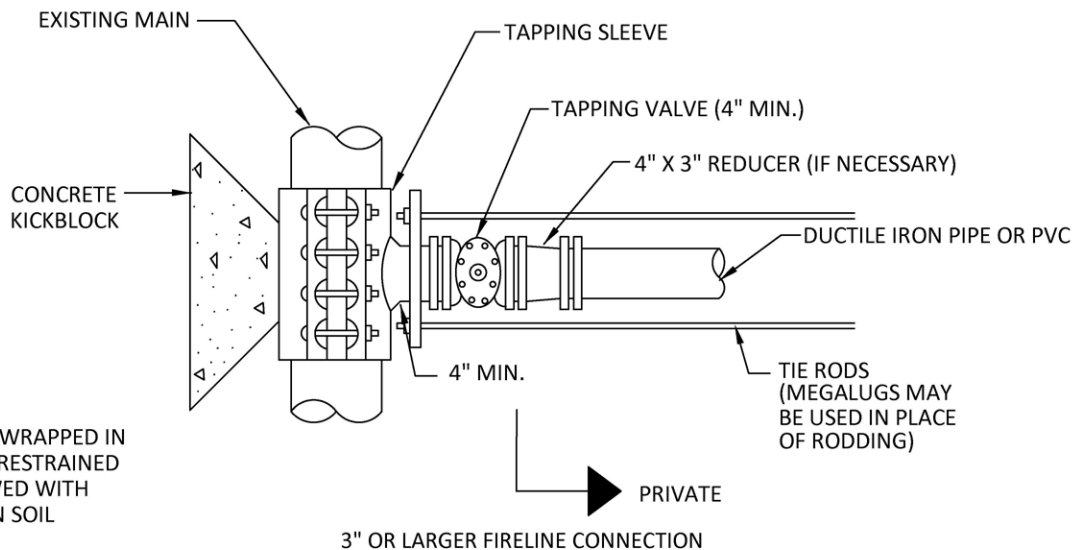
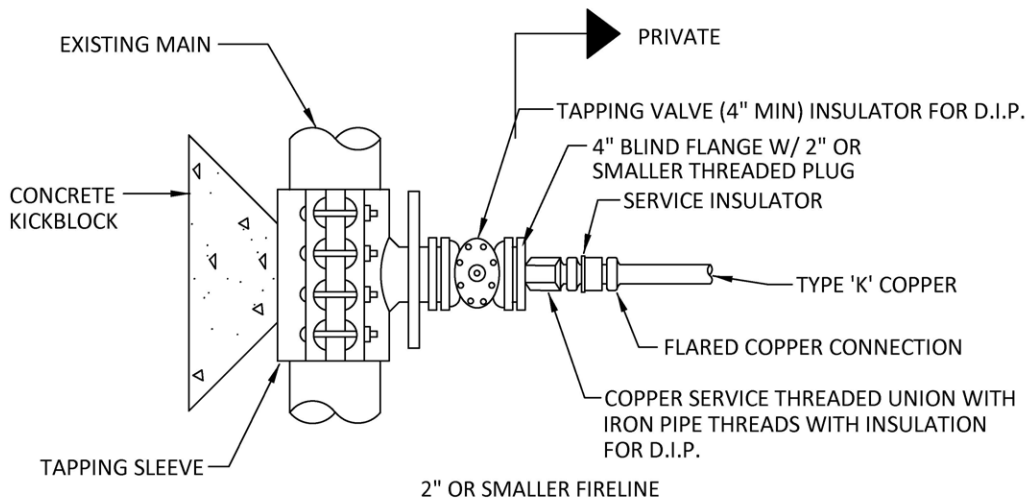
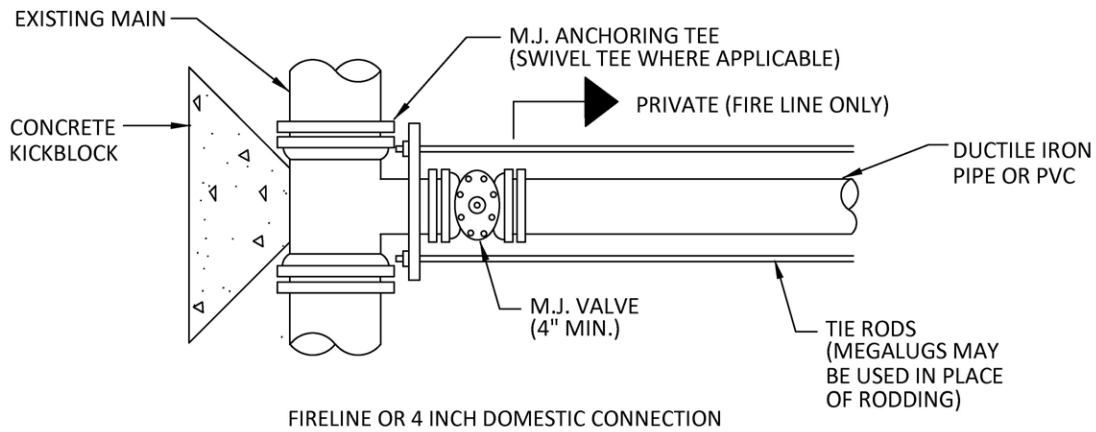
09/23/2019  
DATE

## WATER LINE LOWERING DETAIL

1 of 1

221-1

# STANDARD



## NOTE:

1. ALL PIPE SHALL BE WRAPPED IN POLYETHYLENE AND RESTRAINED
2. PVC PIPE IS ALLOWED WITH APPROVAL BASED ON SOIL RESISTIVITY TESTING.



*David A. Schell*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

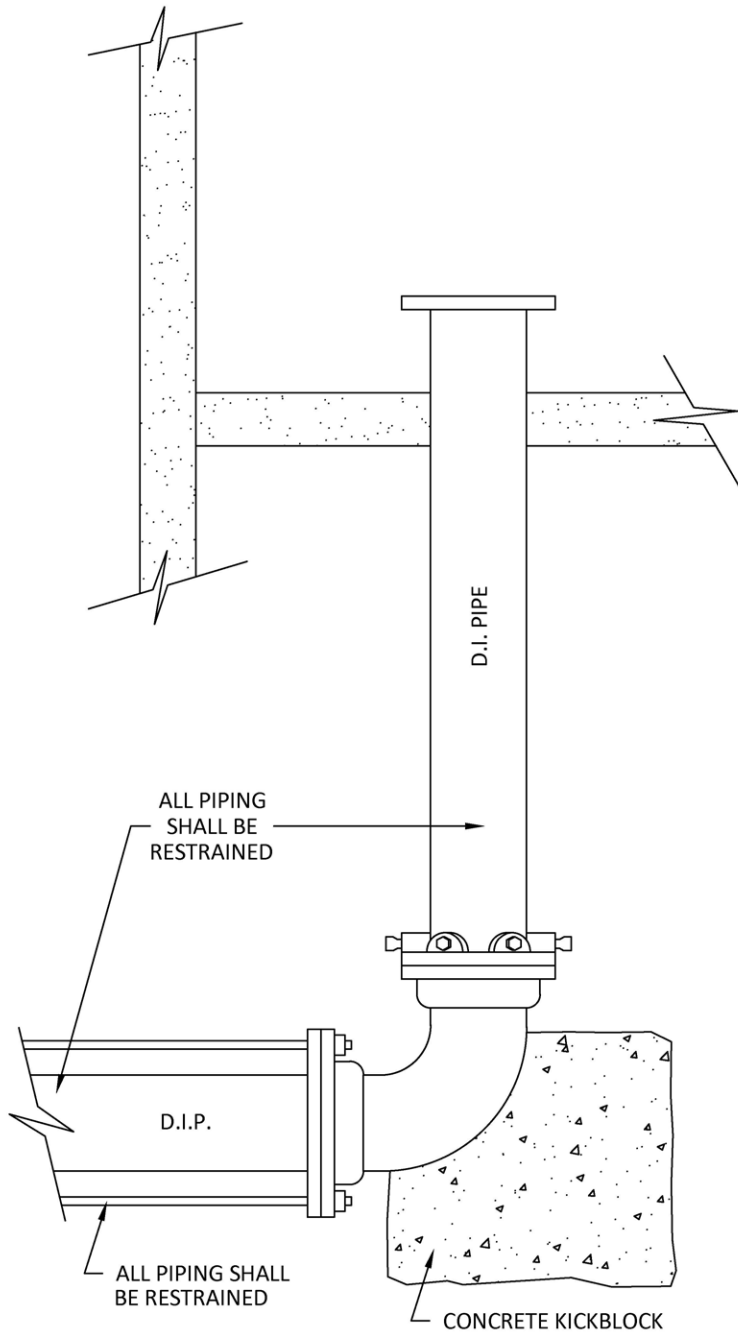
09/23/2019  
DATE

THRUST BLOCK & TIE BACK  
DETAIL (FIRE SUPPRESSION  
SYSTEMS ONLY)

1 of 2

222-1

# STANDARD



## FLANGE SPIGOT

NOTE:

1. PVC PIPE IS ALLOWED WITH APPROVAL BASED ON SOIL RESISTIVITY TESTING.



AURORA  
WATER

*David A. Rehder*  
CITY ENGINEER

09/25/2019  
DATE

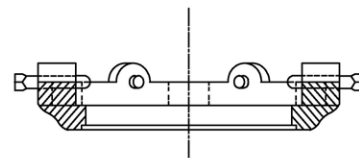
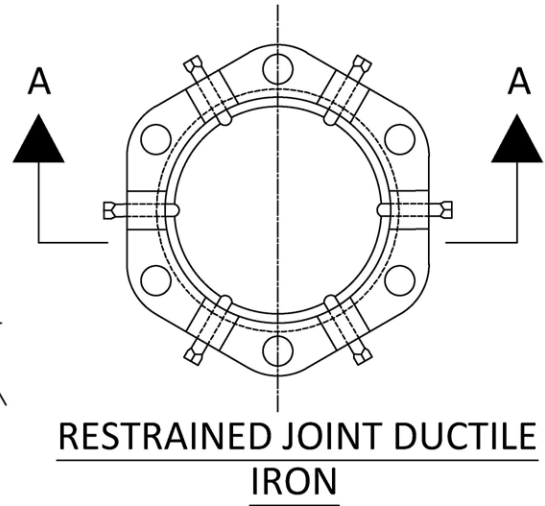
*Vernon A. Adam*  
AURORA WATER

09/23/2019  
DATE

THRUST BLOCK & TIE BACK  
DETAIL (FIRE SUPPRESSION  
SYSTEMS ONLY)

2 of 2

222-2



## SECTION A-A

NOTE: SUCH DEVICES SHOULD BE  
TORQUED TO MANUFACTURERS  
RECOMMENDATIONS

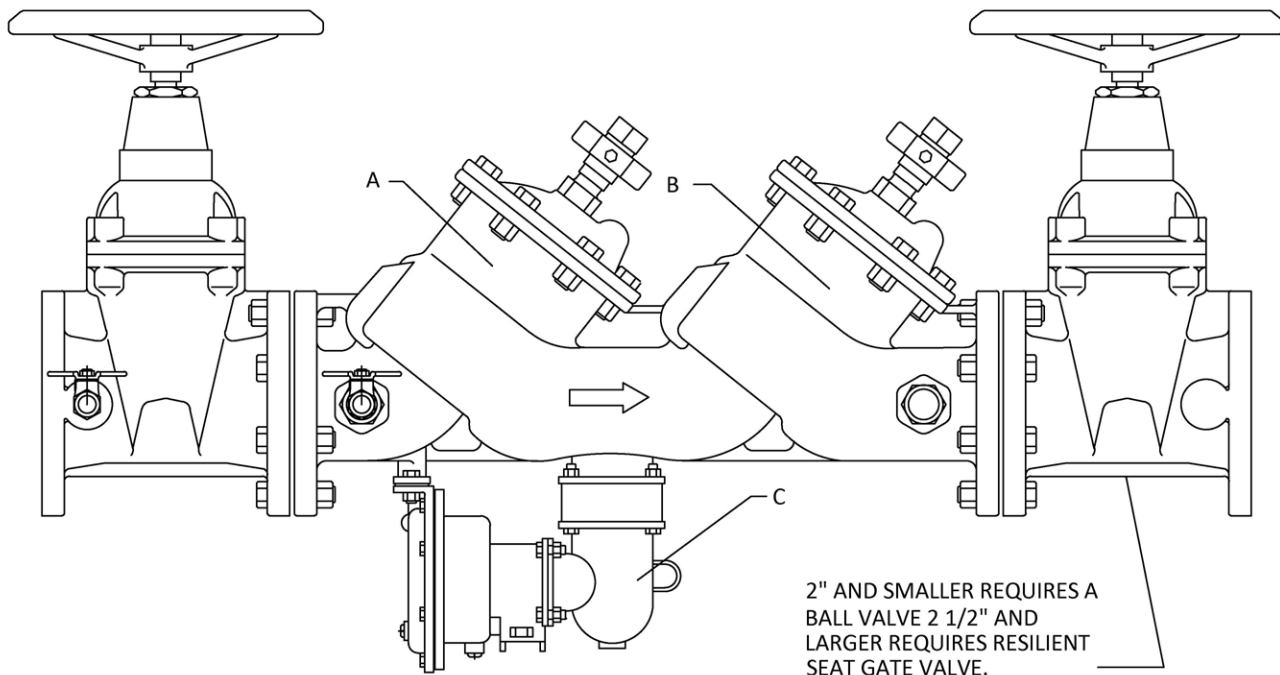
# STANDARD

## TYPICAL REDUCED PRESSURE BACKFLOW PREVENTION DEVICE

### DESCRIPTION:

THE REDUCED PRESSURE BACKFLOW PREVENTER OPERATES ON THE PRINCIPLE THAT WATER WILL NOT FLOW FROM A ZONE OF LOWER PRESSURE TO ONE OF HIGHER PRESSURE. IT PROVIDES MAXIMUM PROTECTION AGAINST BACKFLOW CAUSED BY BOTH BACKPRESSURE AND BACKSIPHONAGE.

THE DEVICE CONSISTS OF TWO SPRING-LOADED CHECK VALVES (A AND B) AND A SPRING-LOADED DIAPHRAGM ACTUATED DIFFERENTIAL PRESSURE RELIEF VALVE (C) LOCATED IN THE ZONE BETWEEN THE CHECK VALVES.



### OPERATION:

THE FIRST CHECK VALVE (A) CAUSES ALL WATER PASSING THROUGH IT TO BE AUTOMATICALLY REDUCED IN PRESSURE.

THE SECOND CHECK VALVE (B) IS LIGHTLY SPRING-LOADED AND FORMS THE "DOUBLE CHECK" FEATURE OF THE DEVICE. IT ACTS TO PREVENT UNNECESSARY DRAINAGE OF THE DOMESTIC SYSTEM IN CASE A BACKFLOW CONDITION OCCURS.

THE RELIEF VALVE (C) IS SPRING-LOADED TO REMAIN OPEN, AND DIAPHRAGM ACTUATED TO CLOSE BY MEANS OF DIFFERENTIAL PRESSURE.

SEE DETAIL 224 FOR FLOOR DRAIN CAPACITIES.

SEE SECTION 19.00 FOR ADDITIONAL REQUIREMENTS.



*Theresa A. Reddy*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

09/25/2019  
DATE  
09/23/2019  
DATE

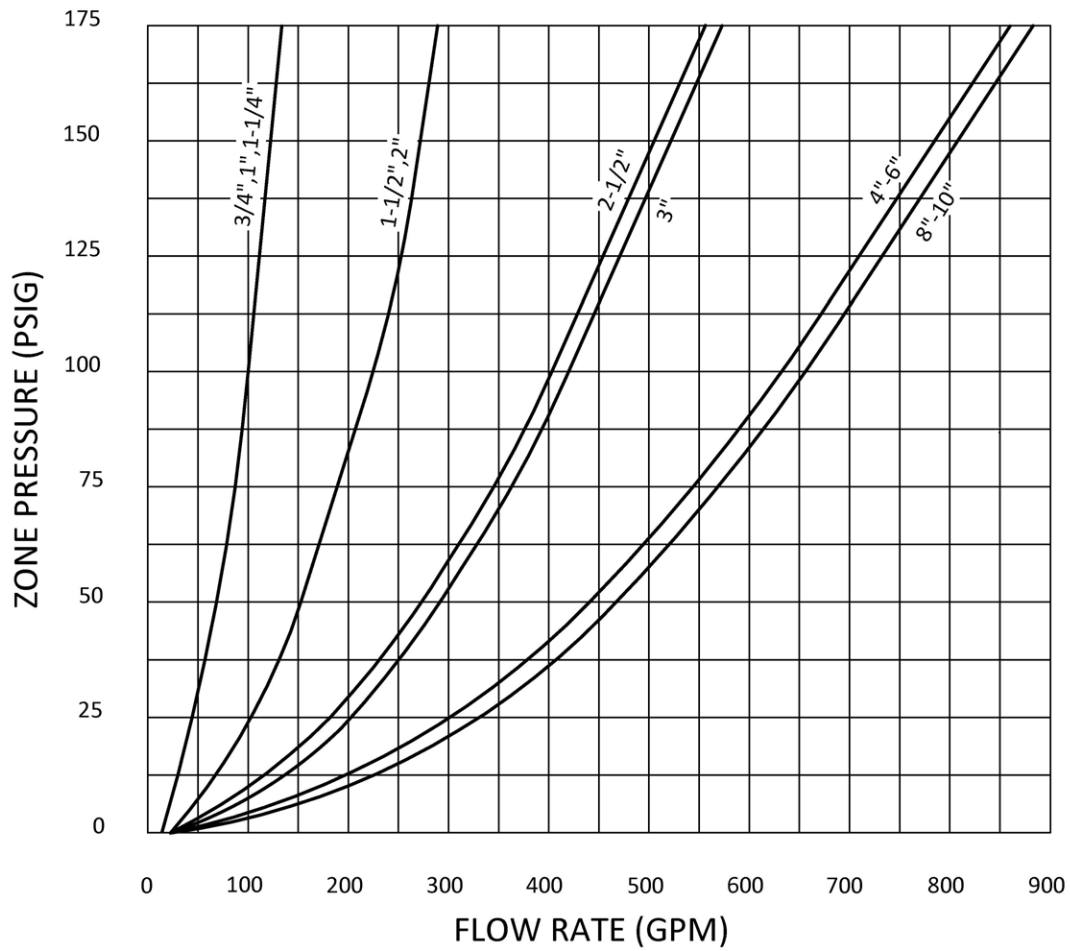
BACKFLOW  
PREVENTION DEVICE

1 of 1

223-1



# STANDARD



TYPICAL FLOW RATES  
AS SIZED BY FLOOR  
DRAIN MANUFACTURES

2" 55 GPM  
3" 112 GPM  
4" 170 GPM  
5" 350 GPM  
6" 450 GPM  
8" 760 GPM

NOTE:  
FLOOR DRAIN CAPACITIES ARE ESTABLISHED BY THE FLOOR  
DRAIN MANUFACTURERS.



*David A. Reheul*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

09/23/2019  
DATE

## BACKFLOW PREVENTOR DRAIN FLOW CHART

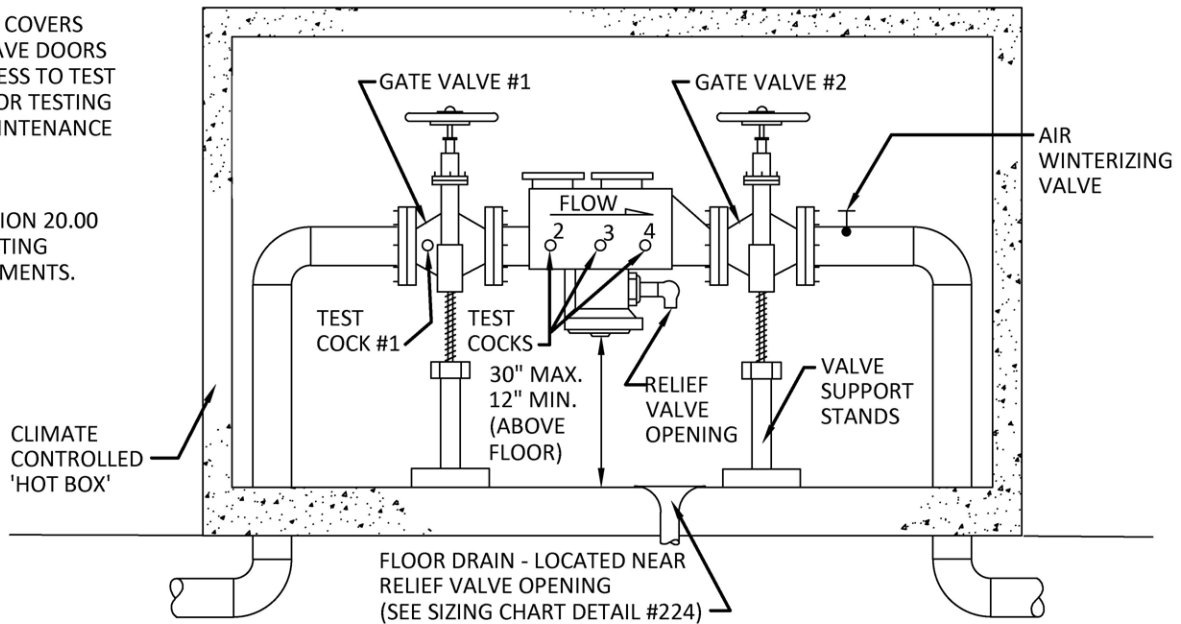
1 of 1

224-1

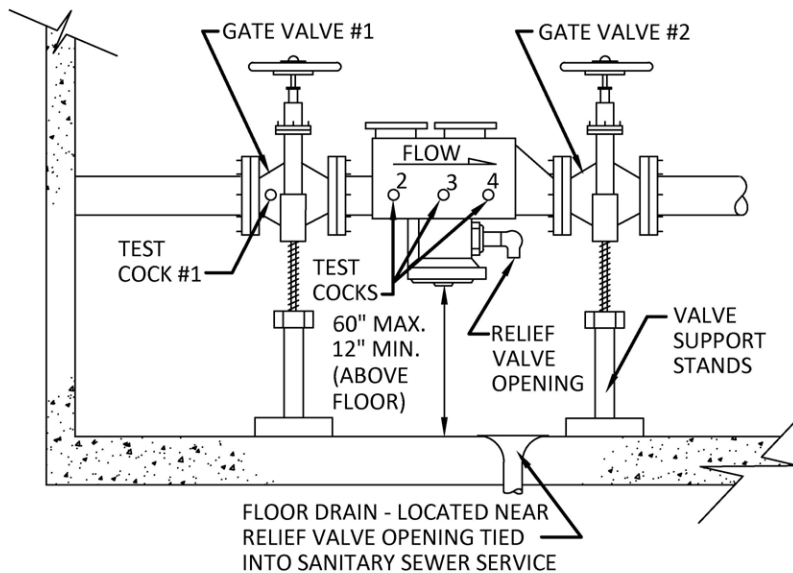
# STANDARD

NOTE:  
OUTSIDE COVERS  
MUST HAVE DOORS  
FOR ACCESS TO TEST  
COCKS FOR TESTING  
AND MAINTENANCE

SEE SECTION 20.00  
FOR COATING  
REQUIREMENTS.



**TYPICAL INSTALLATION OF REDUCED  
PRESSURE PRINCIPLE DEVICE (OUTSIDE)**



**TYPICAL INSTALLATION OF REDUCED  
PRESSURE PRINCIPLE DEVICE (IN BUILDING)**



*Steve A. Reubels*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

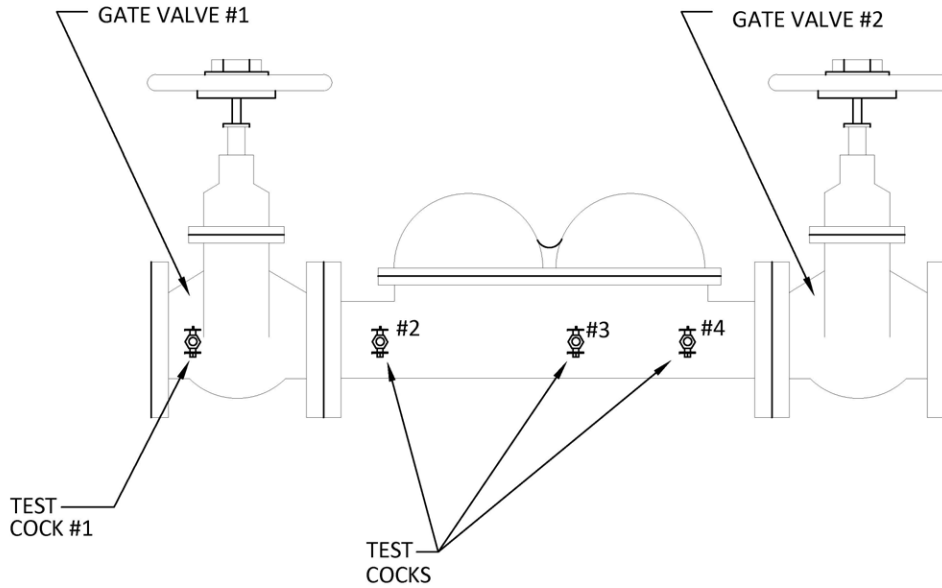
09/25/2019  
DATE  
09/23/2019  
DATE

**BACKFLOW PREVENTION  
INSTALLATION**

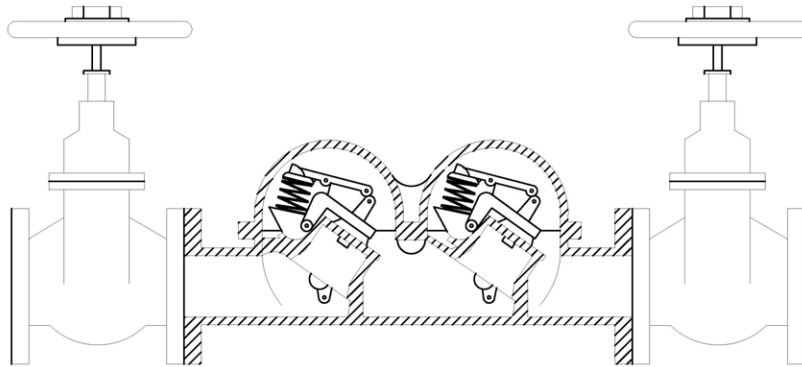
1 of 1

**225-1**

# STANDARD



TYPICAL DOUBLE CHECK VALVE ASSEMBLY  
FIRE LINES ONLY



AURORA  
WATER

*[Signature]*  
CITY ENGINEER

09/25/2019

DATE

*[Signature]*  
AURORA WATER

09/23/2019

DATE

TYPICAL DOUBLE CHECK  
VALVE ASSEMBLY

1 of 1

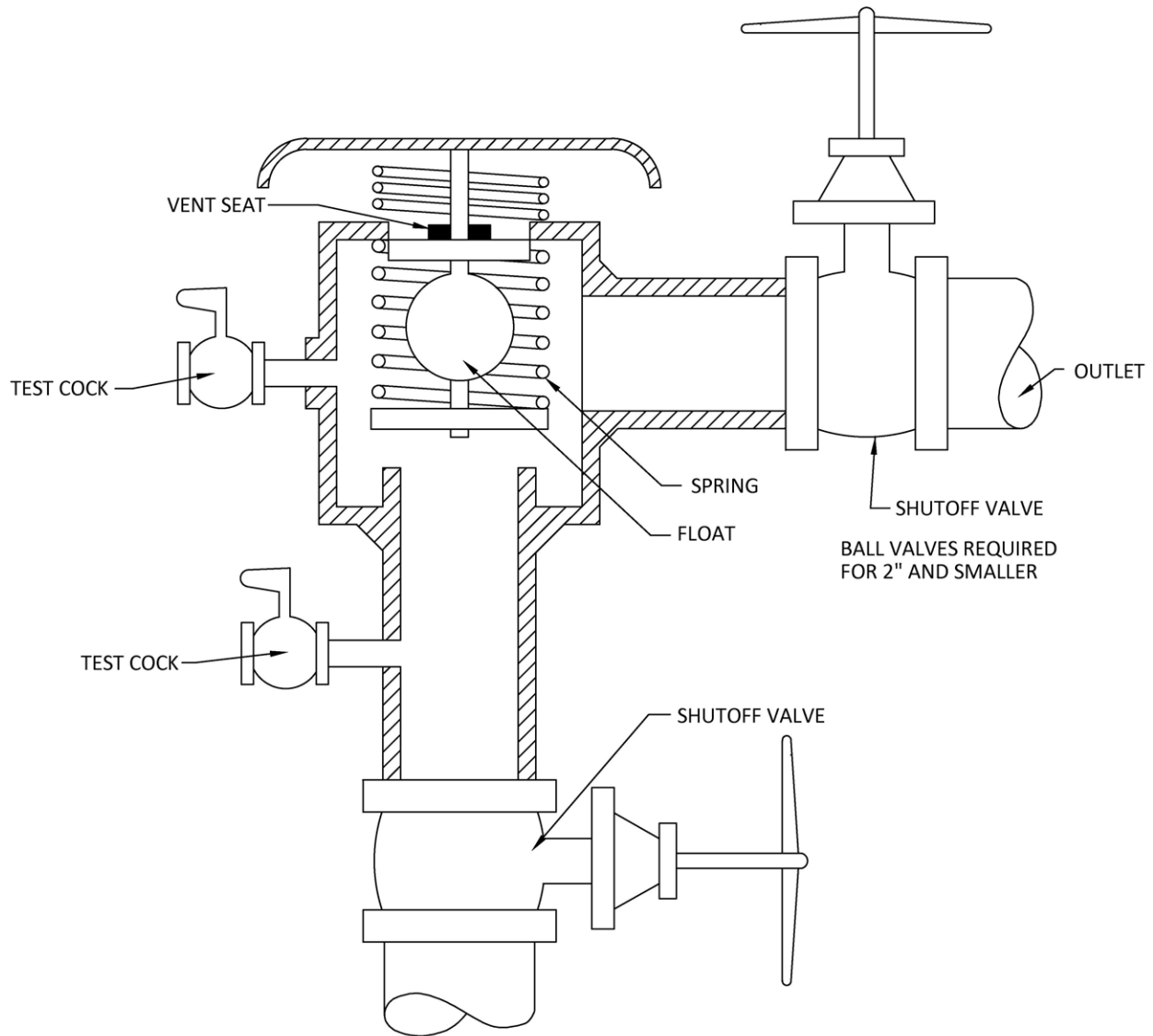
226-1



# STANDARD

## TYPICAL PRESSURE TYPE VACUUM BREAKER

1. PRESSURE VACUUM BREAKERS SHOULD BE INSTALLED A MINIMUM OF 12" ABOVE THE HIGHEST OUTLET THEY ARE PROTECTING, BUT NO MORE THAN 5 FEET ABOVE GROUND.
2. PRESSURE VACUUM BREAKERS MAY BE INSTALLED UNDER CONTINUOUS LINE PRESSURE FOR LIMITED PERIODS OF TIME.
3. THE PRESSURE VACUUM BREAKER CANNOT BE INSTALLED WHERE THERE CAN BE BACKPRESSURE ANYWHERE DOWNSTREAM OF DEVICE.



AURORA  
WATER

*David A. Schell*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

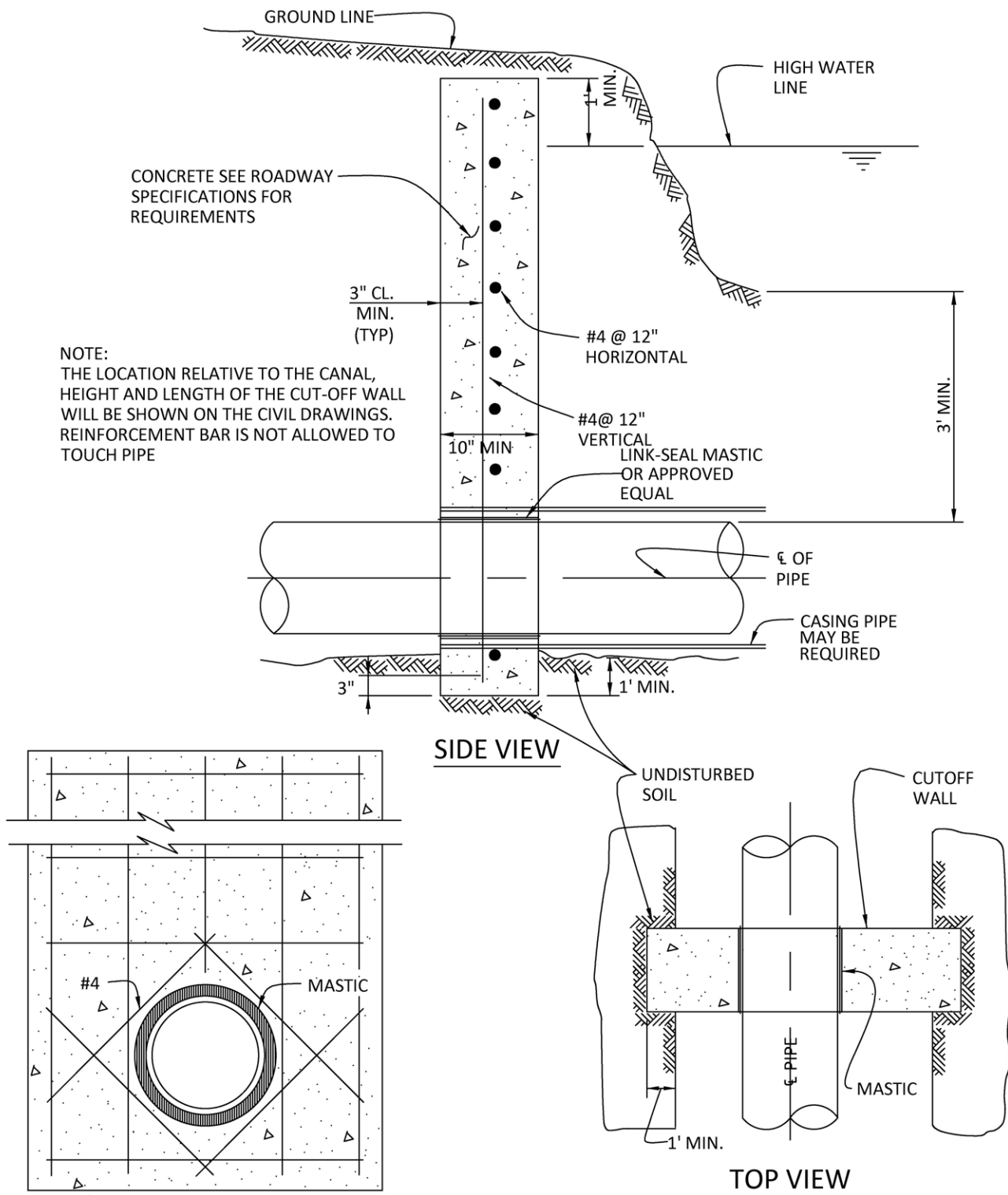
09/23/2019  
DATE

PRESSURE TYPE  
VACUUM BREAKER

1 of 1

227-1

# STANDARD



NOTE: REINFORCEMENT NOT SHOWN.



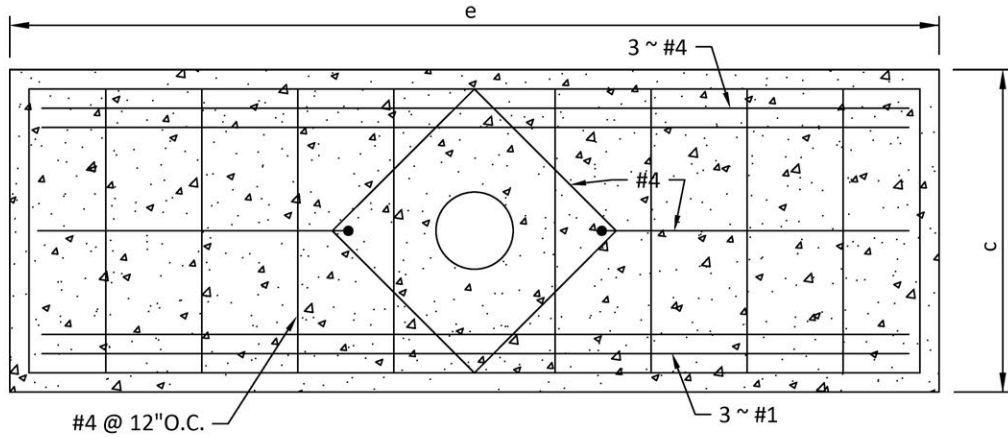
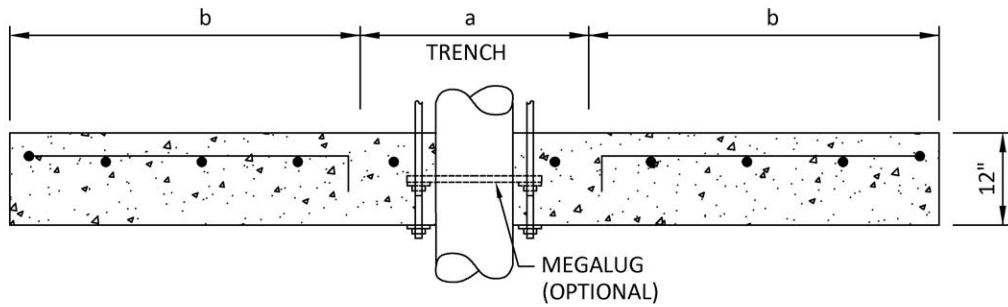
*Steve P. Rush*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

09/25/2019  
DATE  
09/23/2019  
DATE

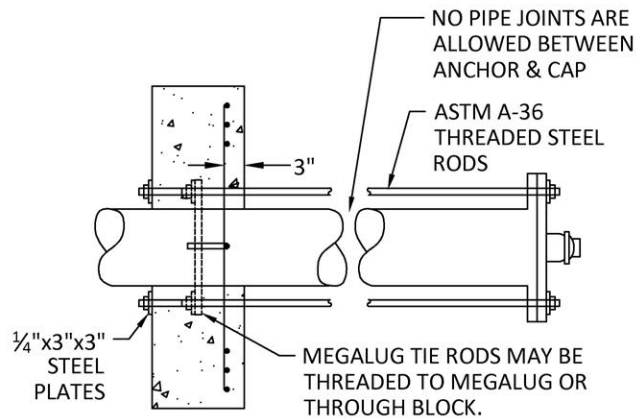
TYPICAL CUT-OFF WALL FOR  
DITCH OR CANAL CROSSING

1 of 1  
228-1

# STANDARD

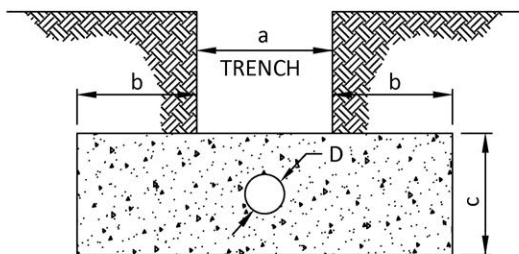


TIE ROD DIAMETERS	
D	ROD
4"	2 ~ 3/4"
6"	2 ~ 3/4"
8"	2 ~ 3/4"
12"	2 ~ 1" OR 4 ~ 3/4"
16"	4 ~ 7/8"
24"	4 ~ 7/8"



## NOTES:

1. 2" B.O. FOR  $< 12"$   $\phi$
2. 6" B.O. FOR  $> 12"$   $\phi$



D	a	b	c	e
4"	20"	12"	28"	44"
6"	22"	12"	32"	46"
8"	24"	18"	38"	60"
12"	32"	30"	44"	92"
16"	36"	60"	42"	156"
24"	40"	73"	64"	186"



AURORA  
WATER

*John A. Reheul*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

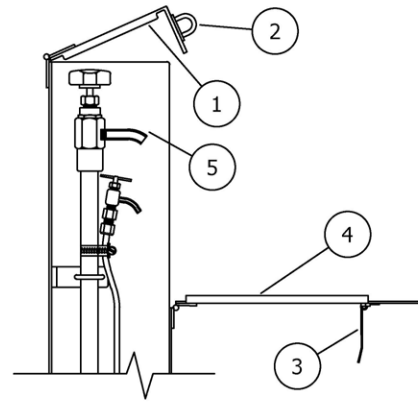
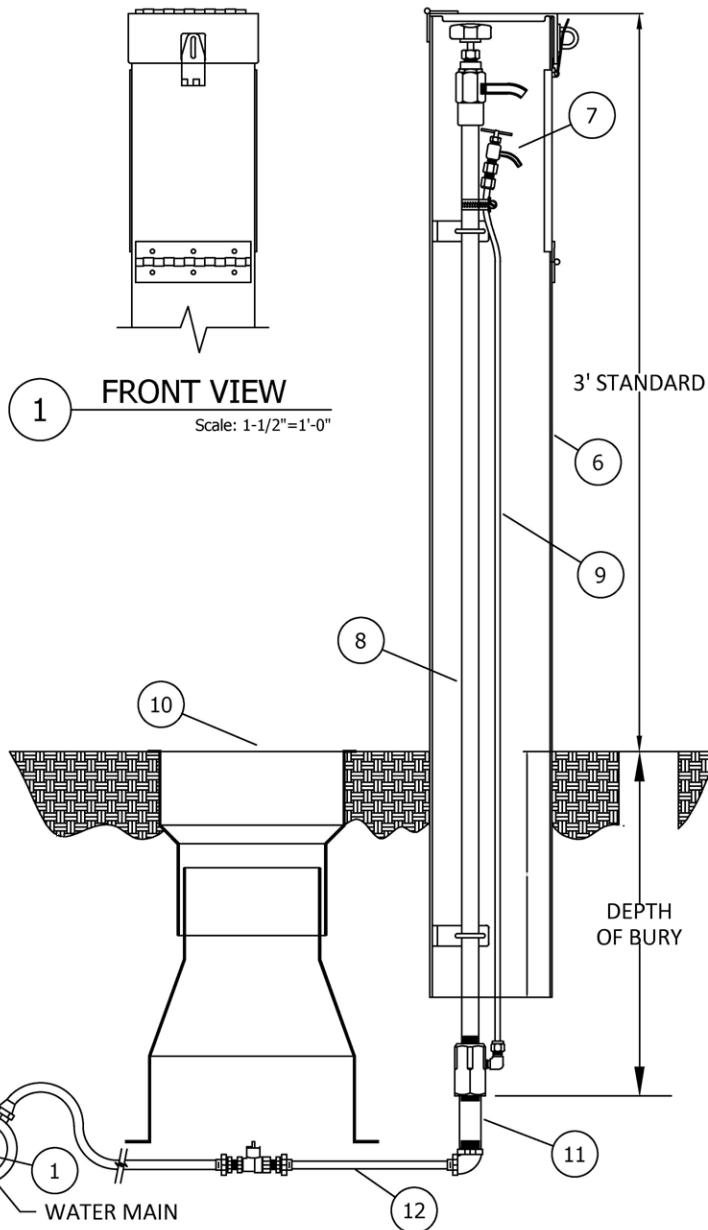
09/23/2019  
DATE

INLINE ANCHOR

1 of 1

229-1

# STANDARD



## NOTES:

1. SAMPLING STATION SHALL BE 4.5' BURY, WITH A 3/4" FIP INLET, AND 7/16" UNTHREADED BLOW OFF AND SAMPLING BIBB.
2. STATION SHALL BE ENCLOSED IN A LOCKABLE, NON-REMOVABLE 6" SQUARE ALUMINUM BOX WITH HINGED OPENINGS.
3. WHEN OPEN, THE STATION SHALL REQUIRE NO KEY FOR OPERATION, AND ALL WATER FLOW SHALL PASS THRU AN ALL STAINLESS STEEL WATERWAY.
4. ALL WORKING PARTS SHALL BE OF STAINLESS STEEL AND SERVICEABLE FROM ABOVE GROUND WITH NO DIGGING OR REPLACEMENT NEEDED.
5. A STAINLESS STEEL PET COCK WILL BE LOCATED BELOW THE SAMPLING BIBB TO ALLOW PUMPING OF ANY WATER REMAINING INSIDE THE STATION TO INSURE NON-FREEZING.
6. THE STATION SHALL BE MODEL #66 AS MANUFACTURED BY THE KUPFERLE FOUNDRY, OR APPROVED EQUAL.
7. SAMPLING STATION SHALL BE LOCATED 5 FEET FROM THE ADJACENT HYDRANT AND EQUIDISTANT FROM THE CURB AS SPECIFIED ON APPROVED PROJECT DRAWINGS

ITEM	ITEM / DESCRIPTION
1	TOP ACCESS DOOR
2	PADLOCK EYE
3	PADLOCK HASP
4	FRONT ACCESS DOOR
5	BLOW OFF & SAMPLING BIBB
6	6" ALUMINUM SQUARE BOX
7	PET COCK
8	1/2" S.S. WATERWAY
9	1/4" S.S. TUBING
10	VALVE BOX & CURB STOP
11	3/4" S.S. NIPPLE
12	3/4" TYPE K COPPER PIPE



*David A. Rehder*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

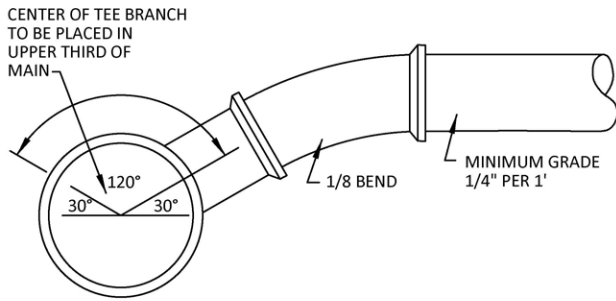
09/23/2019  
DATE

SAMPLING STATION

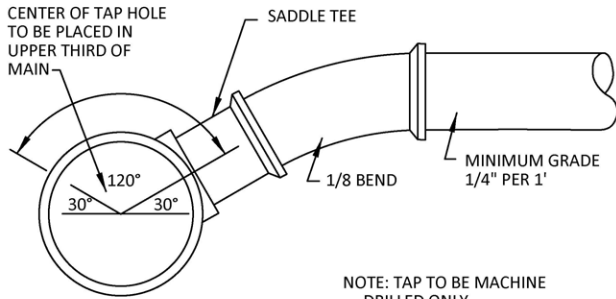
1 of 1

230-1

# STANDARD

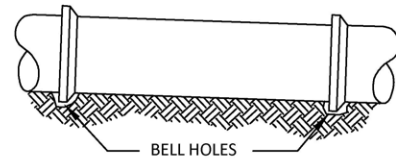


**1/8 BEND CONNECTION TO TEE**

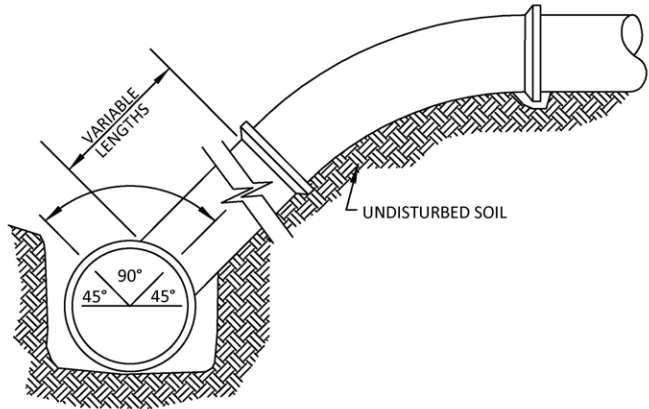


NOTE: TAP TO BE MACHINE  
DRILLED ONLY

**1/8 BEND & SADDLE CONNECTION**



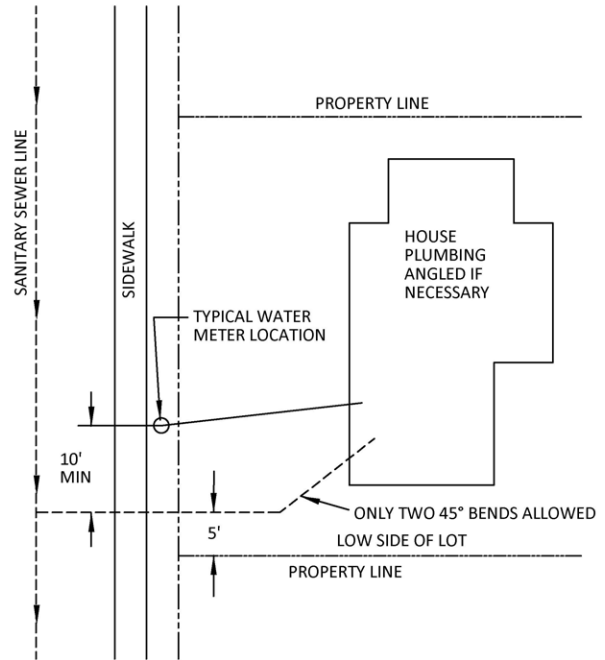
**ACCEPTABLE BENDING**



**RISER DETAIL  
FOR SEWERS OVER 15' DEEP**

## NOTES:

1. BELLS SHALL NOT TOUCH THE SIDES OR THE BOTTOM OF THE BELL HOLE.
2. THE BARREL SECTION SHALL BE SUPPORTED THROUGHOUT ITS LENGTH.
3. SERVICE TAPS SHALL BE IN LINE TEE OR MACHINE TAPPED. HAND TAPS SHALL NOT BE ALLOWED.
4. SERVICE LINES SHALL BE LOCATED 5' DOWNHILL FROM CENTERLINE OF LOT.
5. MINIMUM SERVICE LINES GRADES  
4" SERVICE LATERALS @ 2%  
6" SERVICE LATERALS @ 0.62%
6. JOINTS SHALL BE WATER TIGHT.
7. CLEANOUTS REQUIRED FOR ALL NEW SERVICES AND SERVICE REPAIRS, TO BE LOCATED OUTSIDE OF PUBLIC ROADWAY



**RESIDENTIAL SEWER SERVICE**



**AURORA  
WATER**

*Veronica A. Adam*  
CITY ENGINEER

09/25/2019

DATE

*Veronica A. Adam*  
AURORA WATER

09/23/2019

DATE

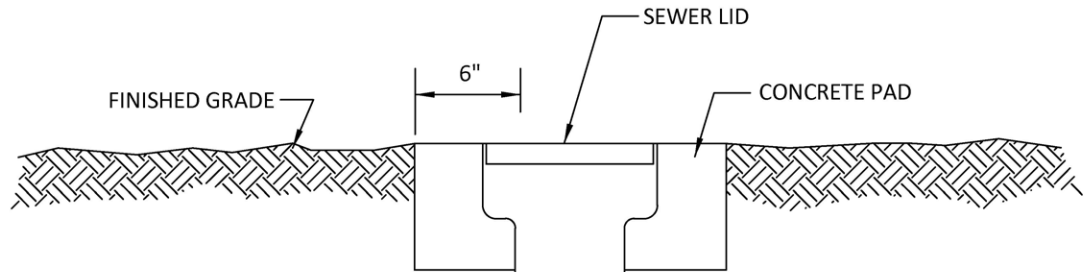
**SANITARY SEWER  
SERVICE DETAIL**

1 of 1

**300-1**

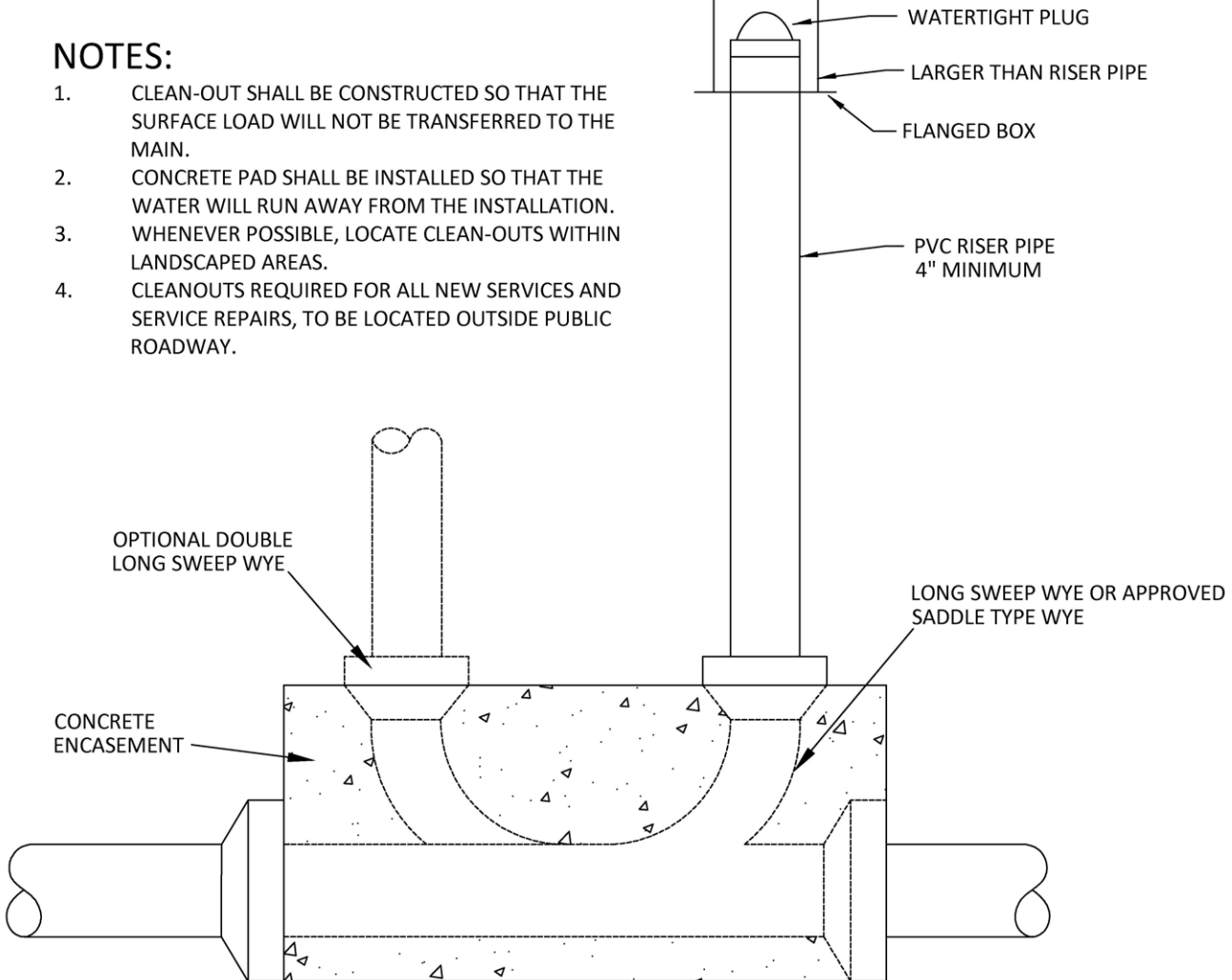


# STANDARD



## NOTES:

1. CLEAN-OUT SHALL BE CONSTRUCTED SO THAT THE SURFACE LOAD WILL NOT BE TRANSFERRED TO THE MAIN.
2. CONCRETE PAD SHALL BE INSTALLED SO THAT THE WATER WILL RUN AWAY FROM THE INSTALLATION.
3. WHENEVER POSSIBLE, LOCATE CLEAN-OUTS WITHIN LANDSCAPED AREAS.
4. CLEANOUTS REQUIRED FOR ALL NEW SERVICES AND SERVICE REPAIRS, TO BE LOCATED OUTSIDE PUBLIC ROADWAY.



*David A. Reilly*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

09/23/2019  
DATE

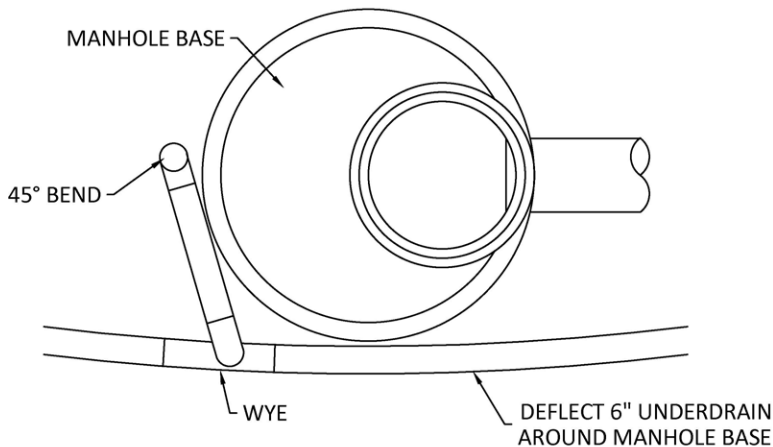
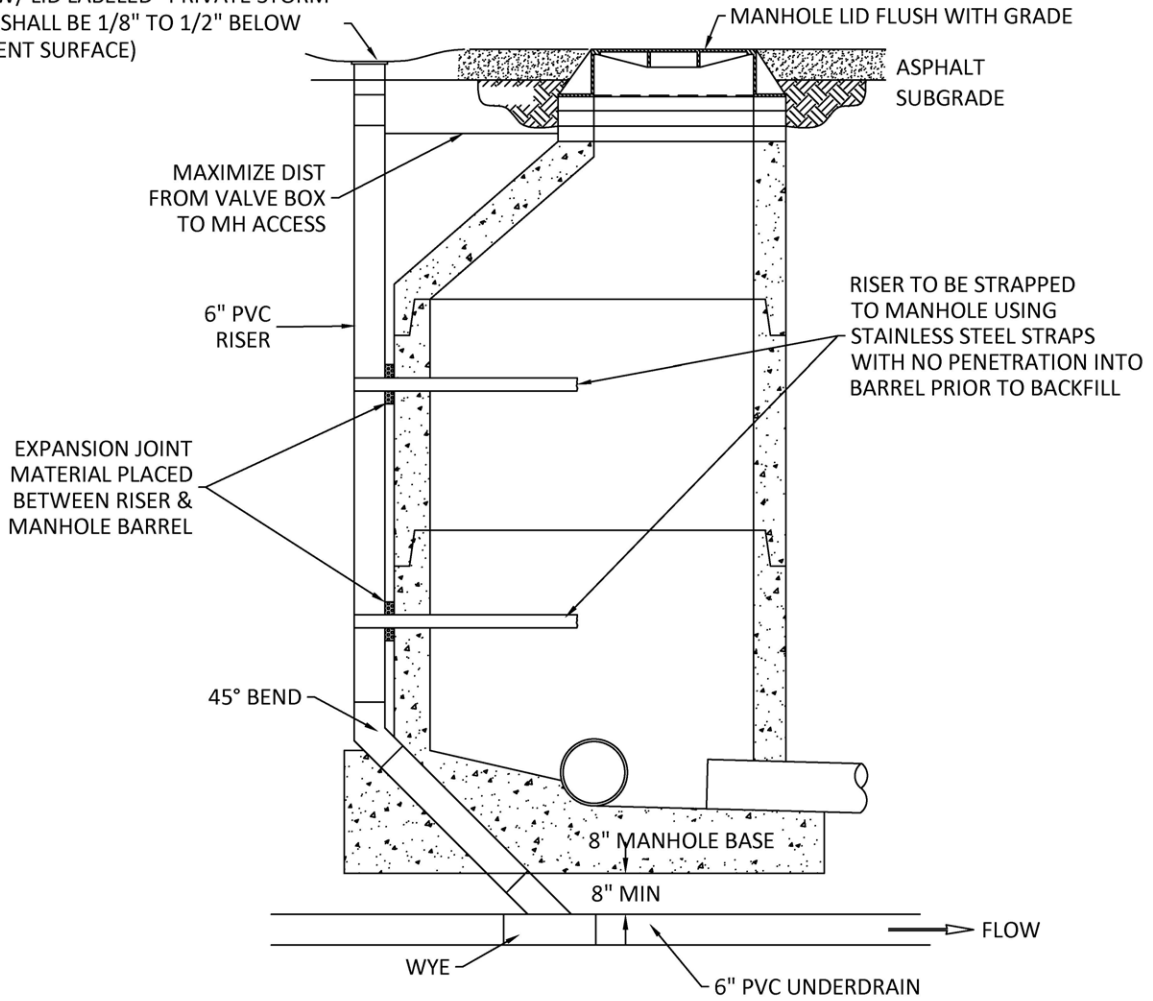
SANITARY SEWER CLEANOUT  
(PRIVATE ONLY)

1 of 1

301-1

# STANDARD

VALVE BOX W/ LID LABELED "PRIVATE STORM"  
(VALVE BOX SHALL BE 1/8" TO 1/2" BELOW  
THE PAVEMENT SURFACE)



## NOTES:

1. PIPE SHALL BE NON-PERFORATED WITHIN 5 FEET OF SANITARY SEWER MANHOLES.
2. PIPE SHALL BE WRAPPED WITH MIRAFI FABRIC SO THAT SOIL CANNOT INFILTRATE THE UNDERDRAIN SYSTEM
3. ALL NON-PERFORATED PVC PIPE SHALL CONFORM TO ASTM 3034-SDR-35. PERFORATED PVC SHALL HAVE PERFORATIONS IN THE LOWER QUADRANT AND BE INSTALLED IN FULL COMPLIANCE WITH ASTM D2321.
4. HDPE PIPE IS AN ACCEPTABLE SUBSTITUTION. ALL NON-PERFORATED PIPE SHALL CONFORM TO AASHTO M252 TYPE "S". ALL PERFORATED HDPE PIPE SHALL CONFORM TO AASHTO M252 TYPE "SP". COLOR SHALL BE BLACK AND RESISTANT TO ULTRAVIOLET RAYS.
5. CLEANOUT VALVE BOXES SHALL BE RATED FOR HS-20 TRAFFIC LOADING.
6. CITY OF AURORA WILL NOT BE RESPONSIBLE FOR MAINTENANCE NOR OWNERSHIP OF UNDERDRAIN SYSTEMS.



AURORA  
WATER

*[Signature]*  
CITY ENGINEER  
*[Signature]*  
AURORA WATER

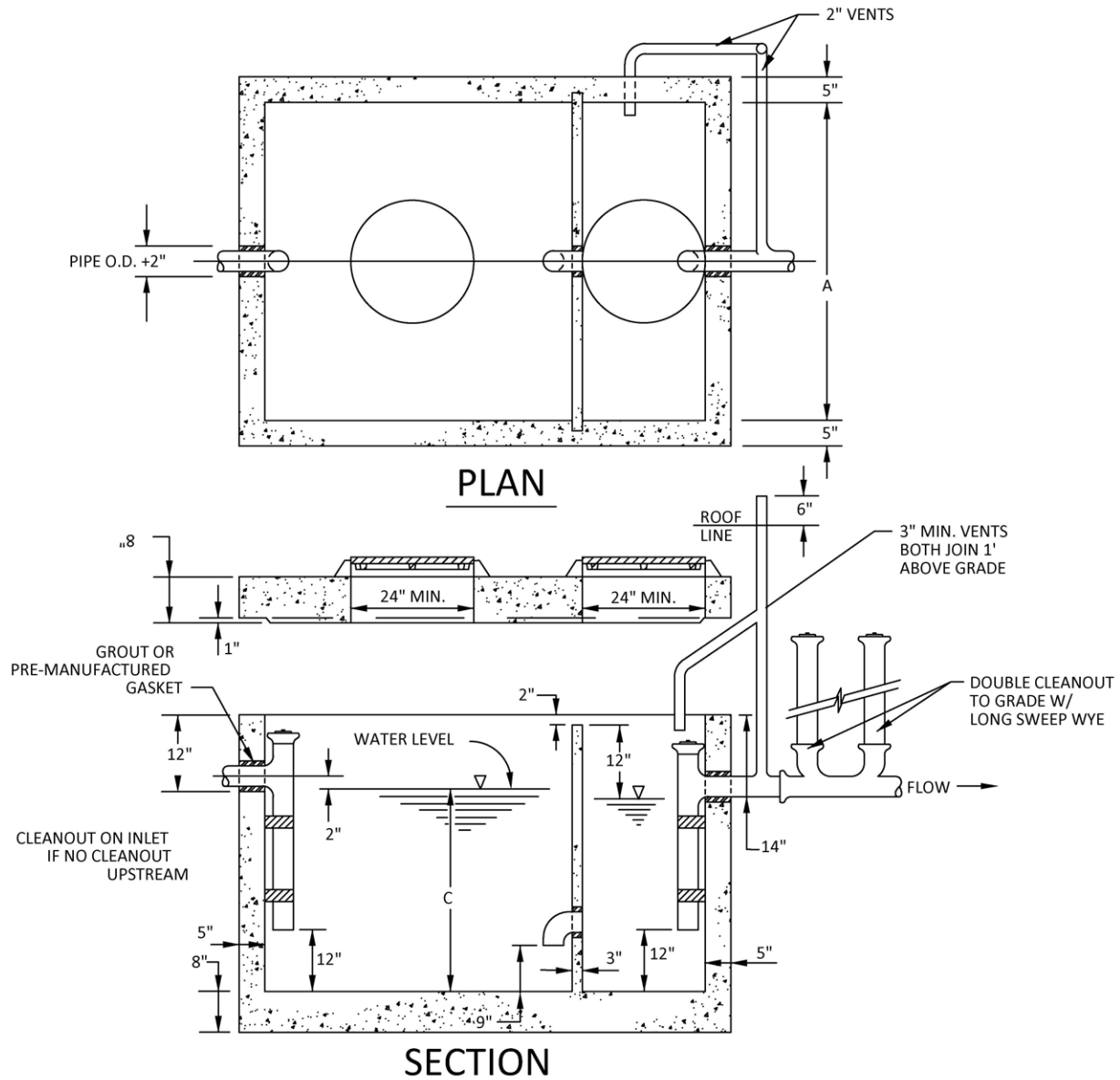
09/25/2019  
DATE  
09/23/2019  
DATE

PRIVATE UNDERDRAIN  
CLEANOUT CONNECTION

1 of 1

302-1

# STANDARD



1. SECONDARY TANK TO BE 1/3 OF TOTAL VOLUME.
2. BAFFLE WALL INSERTS TO BE SEALED IN PLACE.
3. OUTLET PIPE INVERT TO BE 2" LOWER THAN INLET.
4. SUPPORT BRACKETS AND CLEAN-OUT CAPS SHALL BE GALVANIZED STEEL.
5. TANK AND LID TO BE TRAFFIC RATED (HS-20 LOADING)
6. MANHOLE COVERS AND CLEAN-OUT CAPS MUST NOT FALL BELOW GRADE.
7. MANHOLE RING & COVER SHALL BE NEENAH R-1706, OR APPROVED EQUAL.
8. ALL JOINTS IN PRECAST JOINT SECTIONS TO BE SEALED RAMNEK.
9. ALL PIPING TO BE DUCTILE IRON OR SCHEDULE 40 PVC WITH A MINIMUM DIAMETER OF 4" UNLESS OTHERWISE NOTED.
10. NO BOLT DOWN COVERS ALLOWED WITHOUT WRITTEN AUTHORIZATION FROM AURORA WATER ENGINEERING.
11. VENT PIPES SHALL BE CAST IRON OR SCHEDULE 40 PVC AND CAN JOIN TOGETHER AT 1" ABOVE GRADE.
12. INLET AND OUTLET RISER PIPES SHALL BE ANCHORED TO WALL AT 4" BELOW PIPE OPENING.
13. SEE APPENDIX C FOR ADDITIONAL WASTEWATER CONTROL REGULATIONS.
14. CLASS B BEDDING REQUIRED FOR PIPES.

## STANDARD ACCEPTED TANK SIZES (GALLONS)

800  
1000  
1500  
2000  
2500  
3000  
LARGER SIZES BY SPECIAL DESIGN  
APPROVED BY AURORA WATER ENGINEERING



**AURORA  
WATER**

*David A. Reckh*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

09/23/2019  
DATE

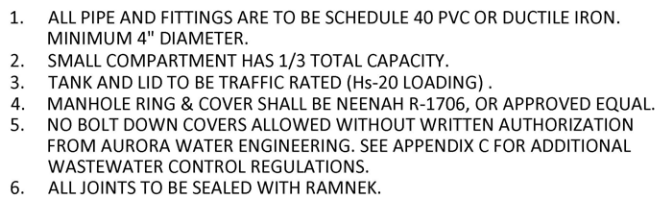
**RECOMMENDED  
GREASE INTERCEPTOR**

1 of 1

**303-1**



\\AURORA\FILES\DEPT\PUBLIC WORKS\PWD\PWD\DRAW\STANDARD\UTIL-STD\2019 REVISION\304-1.DWG



STANDARD ACCEPTED  
TANK SIZES (GALLONS)

320  
500  
800  
1000  
1500  
2000  
2500  
3000  
LARGER BY SPECIAL  
DESIGN APPROVED BY  
AURORA WATER ENGINEERING



*Vernon A. Ada*  
CITY ENGINEER  
*Vernon A. Ada*  
AURORA WATER

09/25/2019  
DATE

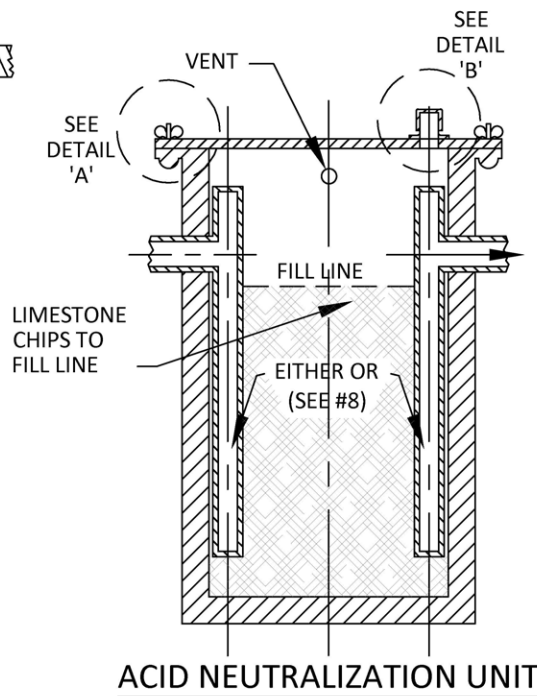
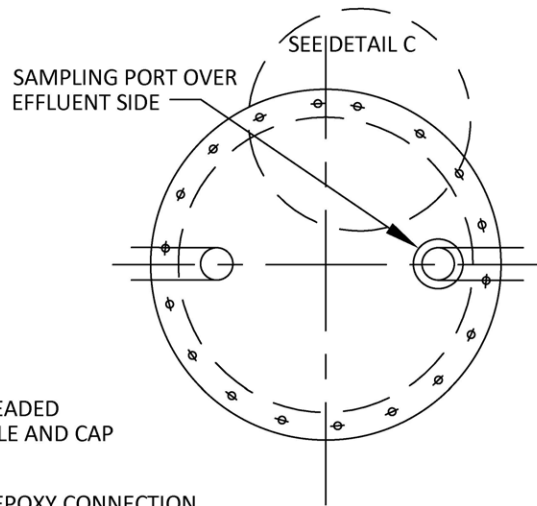
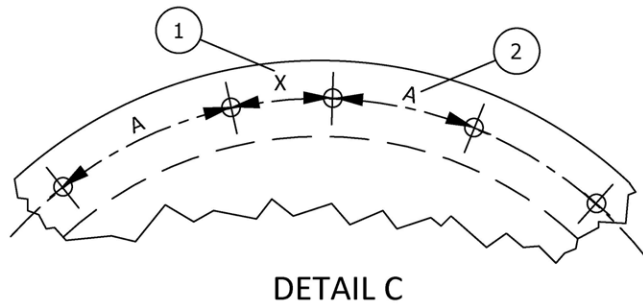
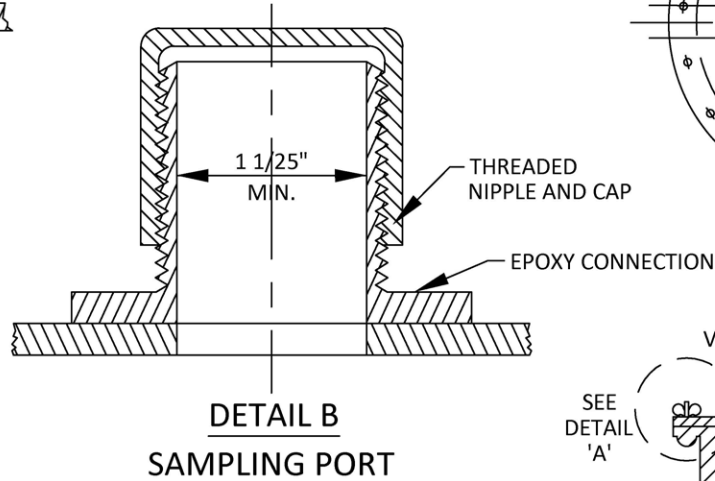
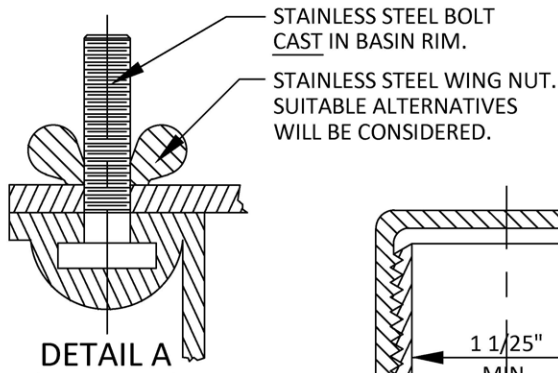
09/23/2019  
DATE

RECOMMENDED  
SAND & OIL INTERCEPTOR  
TYPE 'A' COMMERCIAL

1 of 1

304-1

# STANDARD



1. INTERVAL "X" PROVIDES A KEY SO THAT COVER WILL FIT ONLY WHEN SAMPLING PORT IS IN CORRECT POSITION. SUITABLE ALTERNATIVES WILL BE CONSIDERED.
2. ALL OTHER INTERVALS ARE "A".
3. MOST MANUFACTURERS WILL PLACE THE RISER TO SUIT THE NEEDS OF THE CUSTOMER. THE RISER MUST BE IN ONE LOCATION OR THE OTHER - NOT BOTH.
4. ALL UNITS MUST BE INSTALLED SO THEY ARE EASILY ACCESSIBLE FOR MAINTENANCE AND TESTING.
5. WHERE A UNIT IS TO BE LOCATED UNDERGROUND, A CONCRETE VAULT WITH HATCH ACCESS MUST BE PROVIDED AND SAMPLING PORT MUST BE EXTENDED TO A POINT NO LESS THAN 6" AND NO MORE THAN 12" BELOW THE LEVEL OF THE FINISHED FLOOR OR GROUND.
6. MATERIALS - SPECIFIC MATERIALS MUST BE SELECTED FOR SPECIFIC APPLICATIONS. HIGH DENSITY POLYETHYLENE AND POLYPROPYLENE MATERIALS ARE RECOMMENDED IN MOST CASES. CONCRETE UNITS LINED WITH "ACID RESISTANT" MATERIAL WILL NOT BE APPROVED.
7. ACID NEUTRALIZATION TANKS AND INSTALLATIONS MUST BE INSPECTED AND APPROVED BY AURORA WATER ENGINEERING.
8. SEE APPENDIX C FOR ADDITIONAL WASTEWATER CONTROL REGULATIONS.



*David A. Reck*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

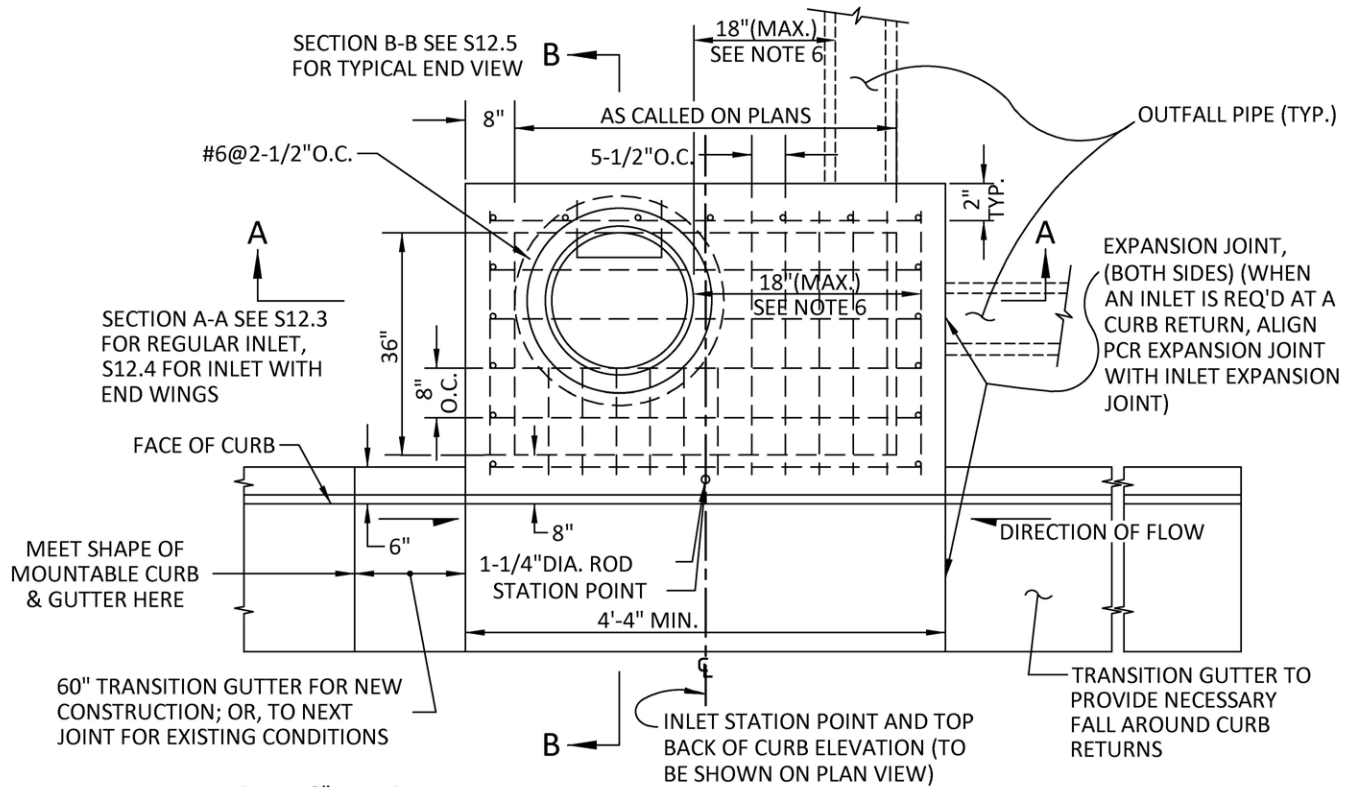
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DATE

## RECOMMENDED ACID NEUTRALIZATION UNIT

1 of 1

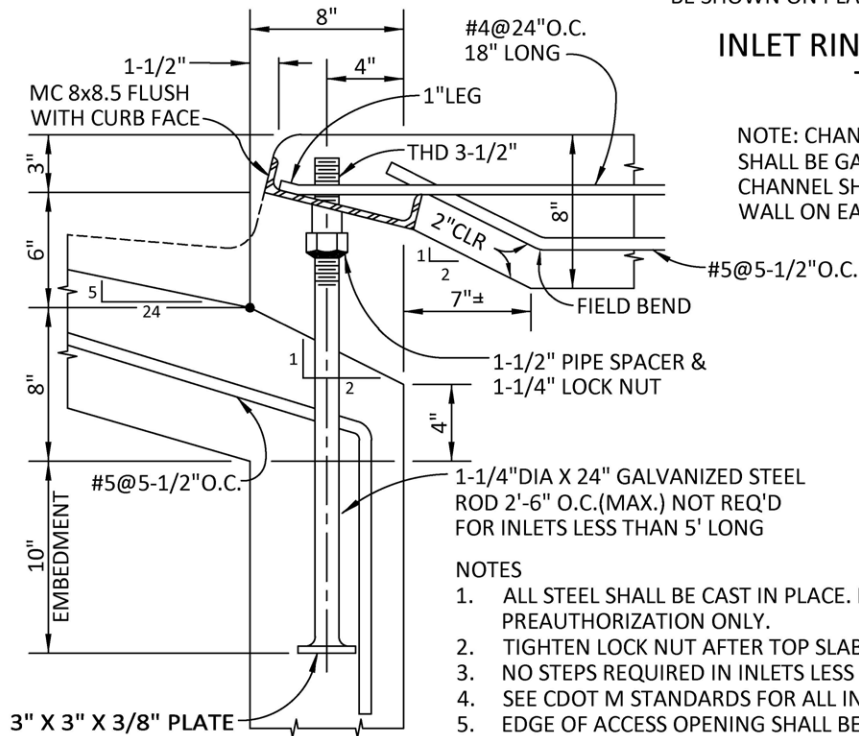
305-1

# STANDARD

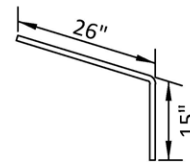


## INLET RING & COVER TO CONFORM TO DETAIL 102-1.

NOTE: CHANNEL AND ALL OTHER EXPOSED STEEL SHALL BE GALVANIZED (AASHTO M111). CHANNEL SHALL BE EXTENDED 5" INTO THE WALL ON EACH SIDE.



## BENDING DIAGRAM



### NOTES

1. ALL STEEL SHALL BE CAST IN PLACE. PRECAST INLETS ALLOWED WITH PREAUTHORIZATION ONLY.
2. TIGHTEN LOCK NUT AFTER TOP SLAB CURES.
3. NO STEPS REQUIRED IN INLETS LESS THAN 36" DEEP, TOP OF DECK TO INVERT.
4. SEE CDOT M STANDARDS FOR ALL INFORMATION NOT SHOWN ON THIS DRAWING.
5. EDGE OF ACCESS OPENING SHALL BE LOCATED NO MORE THAN 18" FROM THE INSIDE FACE OF THE OUTFALL PIPE.
6. FOR ON GRADE INLETS, THE DECK TOP SHALL MATCH THE STREET GRADE.
7. INLETS OVER 10 FEET IN LENGTH REQUIRE TWO ACCESS OPENINGS.

## CURB FACE ASSEMBLY



AURORA  
WATER

*David A. Reilly*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

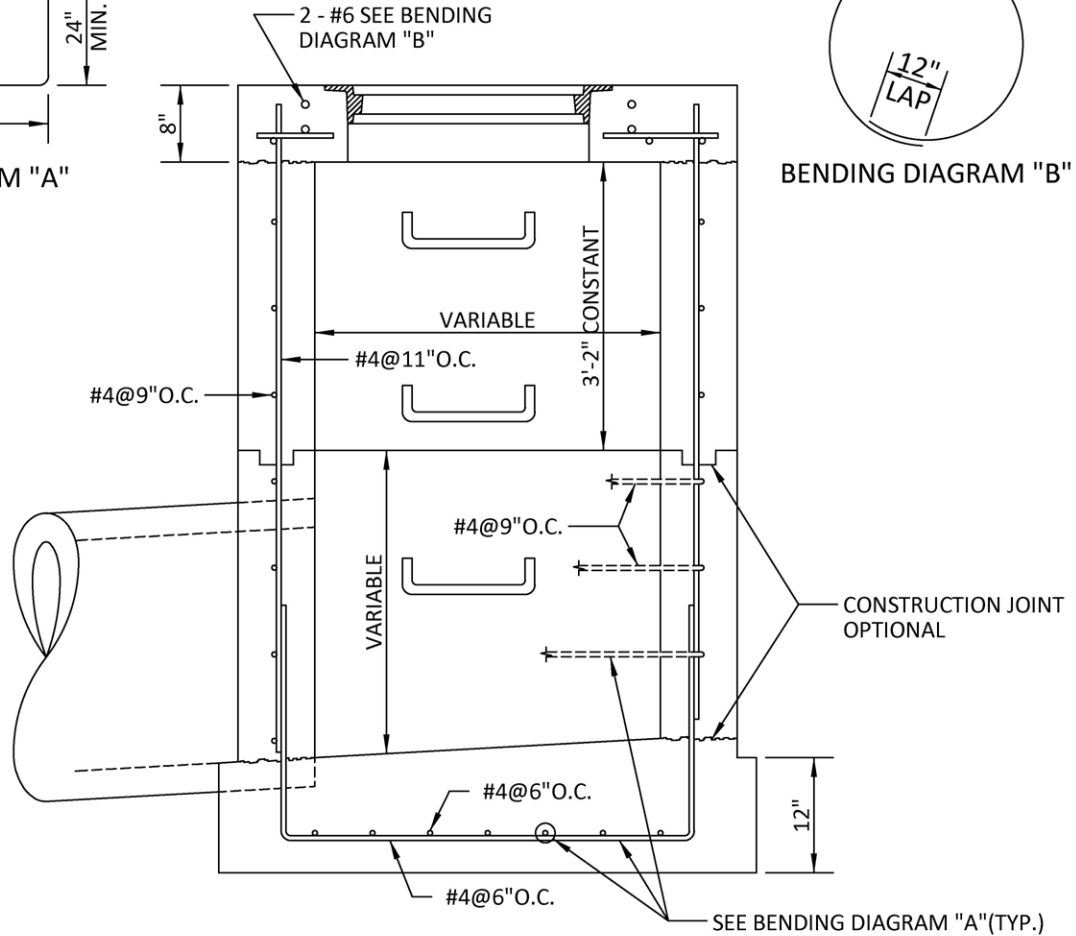
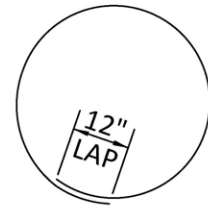
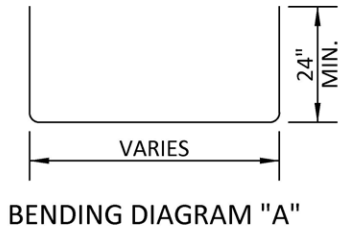
09/23/2019  
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## CURB OPENING INLET TYPE 'R' MODIFIED

1 of 7

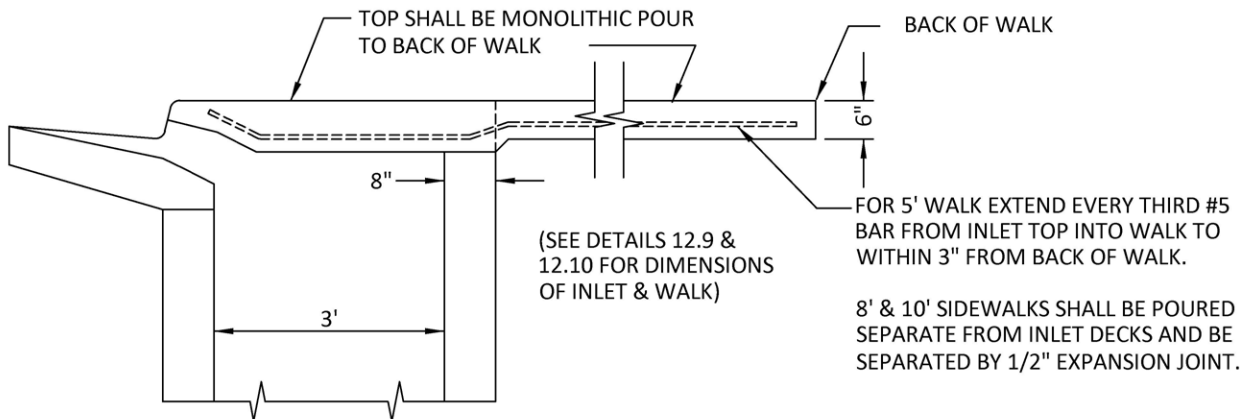
400-1

# STANDARD



**SECTION A-A**  
**REGULAR INLET**  
**NOT TO SCALE**

NOTE:  
ALL CONSTRUCTION JOINTS  
SHALL HAVE A 2'X 4" KEYWAY.



*David A. Rebull*  
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*Vernon A. Adam*  
AURORA WATER

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09/23/2019  
DATE

**CURB OPENING INLET**  
**TYPE 'R' MODIFIED**

2 of 7  
**400-2**

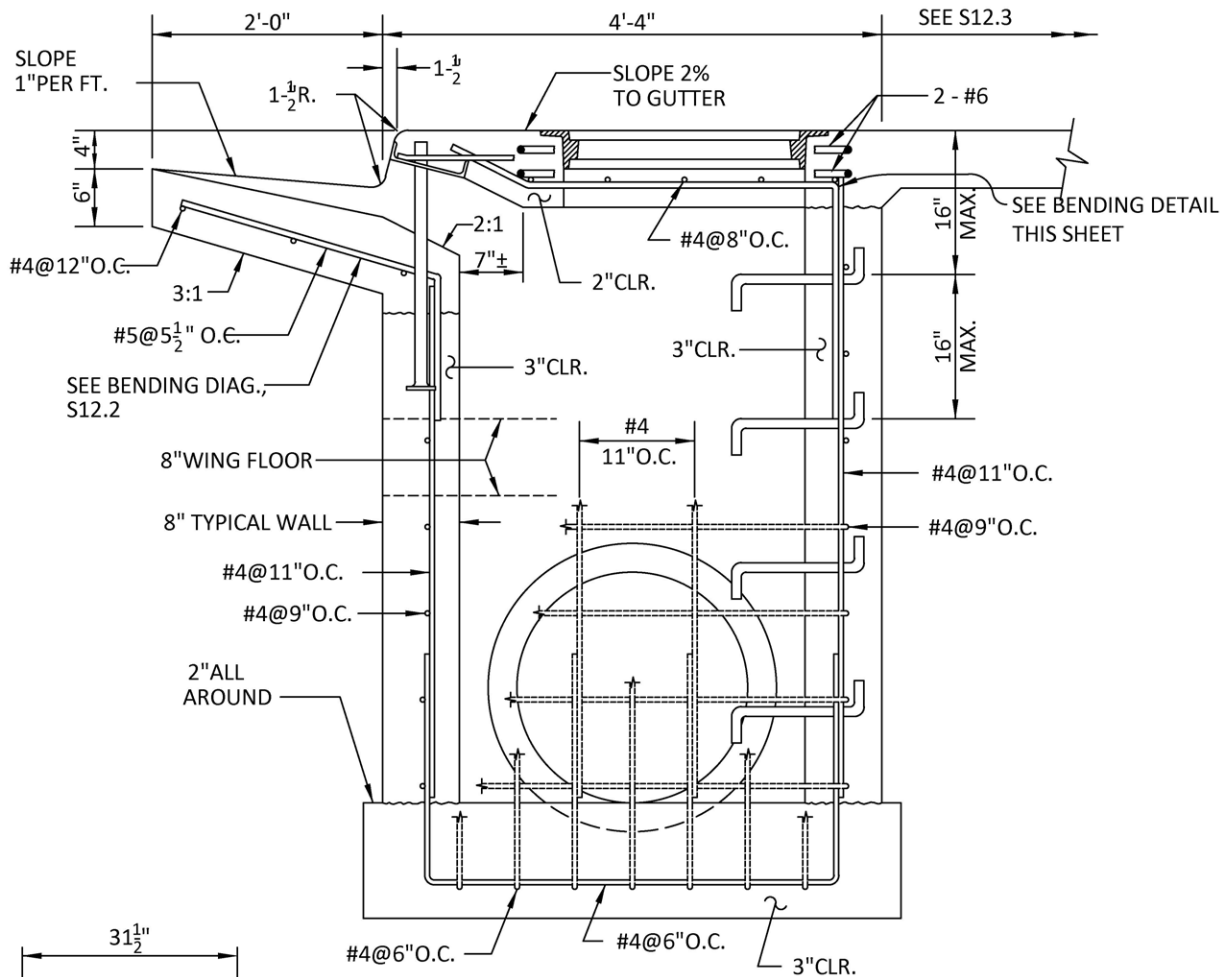


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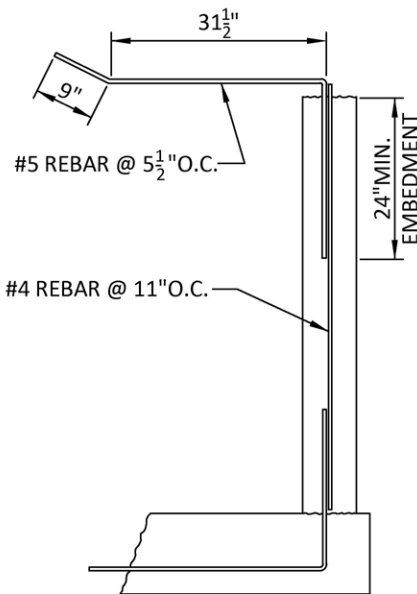
400-3



# STANDARD



**SECTION B-B  
TYPICAL END VIEW**



**BENDING DETAIL**

## NOTES:

1. INLET RING AND COVER TO CONFORM TO DETAIL 400-1
2. STEPS SHALL BE AS SPECIFIED IN DETAILS 105 AND 106 OF CITY OF AURORA PUBLIC UTILITY IMPROVEMENTS RULES AND REGULATIONS REGARDING STANDARDS AND SPECIFICATIONS: WATER, SANITARY, STORM SEWER.
3. ALL #4 REBAR SHALL BE GRADE 40.
4. ALL #5 AND LARGER REBAR SHALL BE GRADE 60.



*David A. Reckels*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

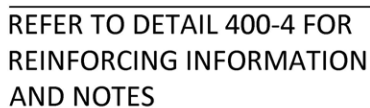
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**CURB OPENING INLET  
TYPE 'R' MODIFIED**

4 of 7

**400-4**

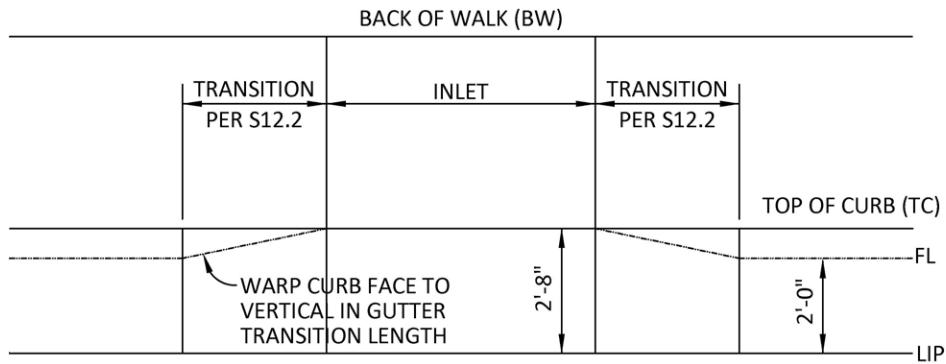
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09/23/2019  
DATE

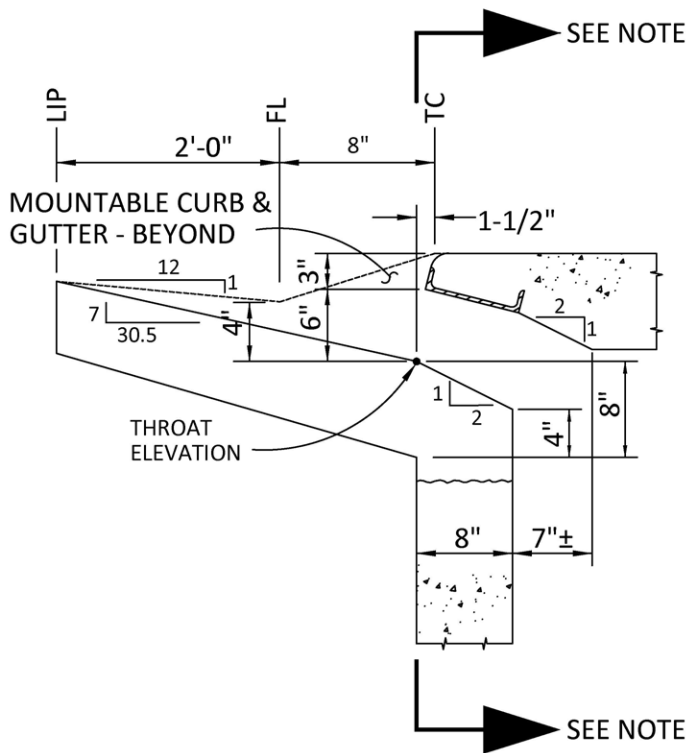
400-5

# STANDARD

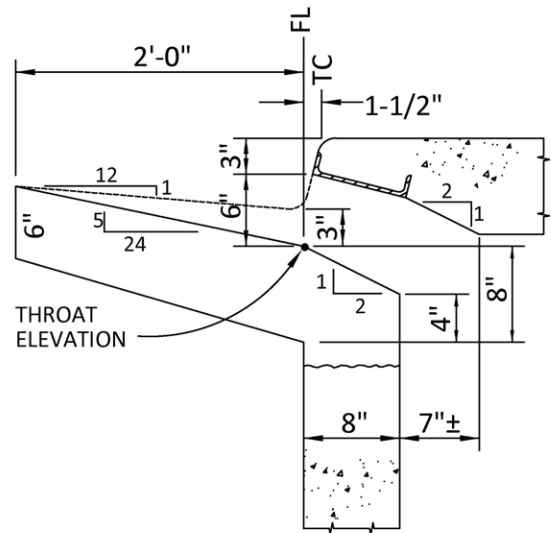


## PLAN

TRANSITION MOUNTABLE CURB &  
GUTTER TO CURB OPENING INLET



THROAT CONFIGURATION DETAIL  
CURB OPENING INLET WITH  
MOUNTABLE CURB & GUTTER



NOTE:  
REFER TO S 400-1 THRU 400-7 FOR  
COMPLETE CONSTRUCTION DETAILS.

THROAT CONFIGURATION DETAIL  
CURB OPENING INLET WITH  
VERTICAL CURB & GUTTER



AURORA  
WATER

*[Signature]*  
CITY ENGINEER

09/25/2019  
DATE

*[Signature]*  
AURORA WATER

09/23/2019  
DATE

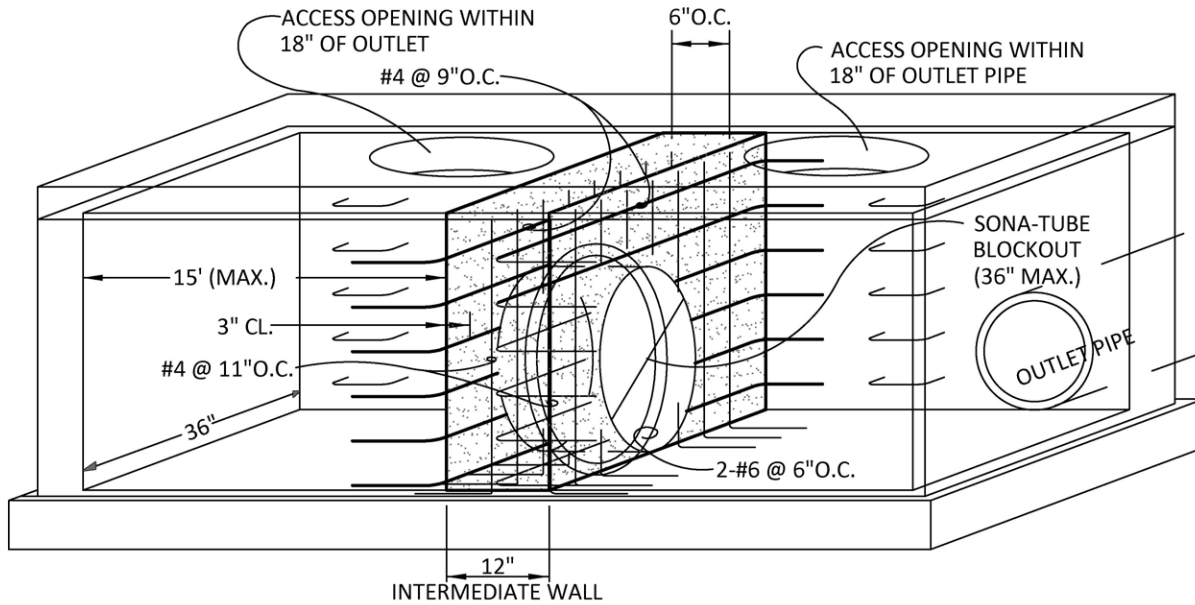
CURB OPENING INLET  
TYPE 'R' MODIFIED

6 of 7

400-6



## INLET DECK IS SHOWN WITHOUT CURB OPENING



### NOTES:

1. PROVIDE A 1 1/2" DEEP CONTROL JOINT THROUGH THE INLET DECK AT EACH INTERMEDIATE WALL PER S7.3 OF THE "ROADWAY DESIGN & CONSTRUCTION SPECIFICATIONS". THE JOINT SHALL EXTEND FROM THE BACK OF THE DECK TO THE FACE OF THE GUTTER PAN.
2. INLET DECK REINFORCEMENT STEEL SHALL BE CONTINUOUS WITH SPLICE LENGTHS OF NO LESS THAN 18". INTERMEDIATE WALL STEEL SHALL TIE INTO THE OUTSIDE WALLS AND FLOOR PER STANDARD DETAILS.
3. ALL INTERMEDIATE WALL CONSTRUCTION SHALL CONFORM TO STANDARD CONSTRUCTION SPECIFICATION AS SHOWN IN STANDARD DETAILS #400, 1 THRU 7 UNLESS OTHERWISE NOTED.



*Theresa A. Reilly*  
CITY ENGINEER  
*Vernon A. Adam*  
AURORA WATER

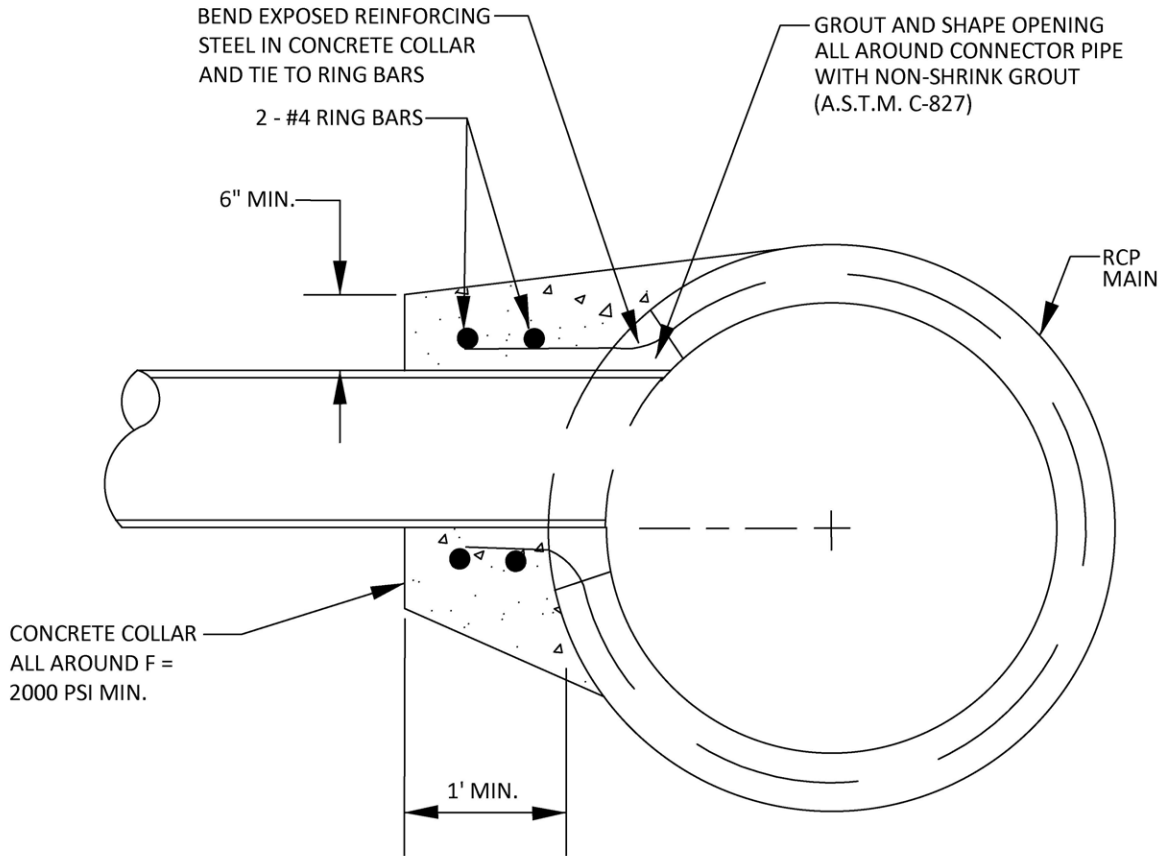
09/25/2019  
DATE  
09/23/2019  
DATE

TYPE 'R' INLET  
(GREATER THAN 15' LENGTH)

7 of 7

400-7

# STANDARD



## NOTE:

1. END OF PIPE SHALL NOT EXTEND PAST INSIDE WALL OF STORM SEWER PIPE.
2. THIS CONNECTION IS PERMISSIBLE WHEN THE INSIDE DIAMETER OF THE CONNECTING PIPE IS LESS THAN ONE-HALF THE INSIDE DIAMETER OF THE MAIN. OTHERWISE, A MANHOLE IS REQUIRED PER DETAIL 102 AT THE POINT OF CONNECTION.
3. THE AURORA WATER DEPT. RESERVES THE RIGHT TO REQUIRE A MANHOLE AT THE POINT OF CONNECTION WHEN DEEMED NECESSARY.



AURORA  
WATER

*Theresa A. Rehulfs*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

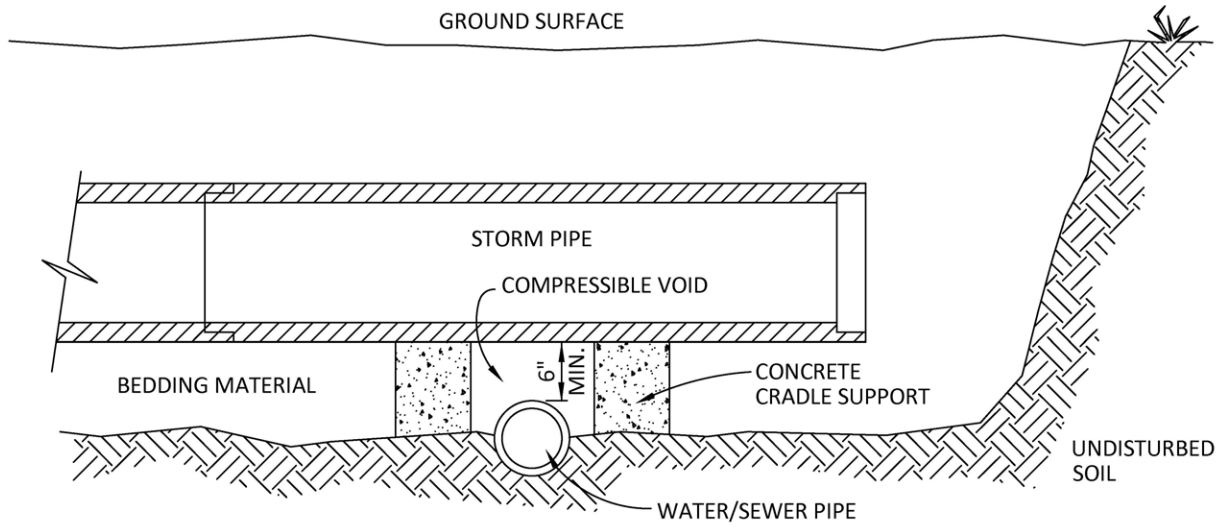
09/23/2019  
DATE

INLET CONNECTION INTO  
STORM SEWER MAIN

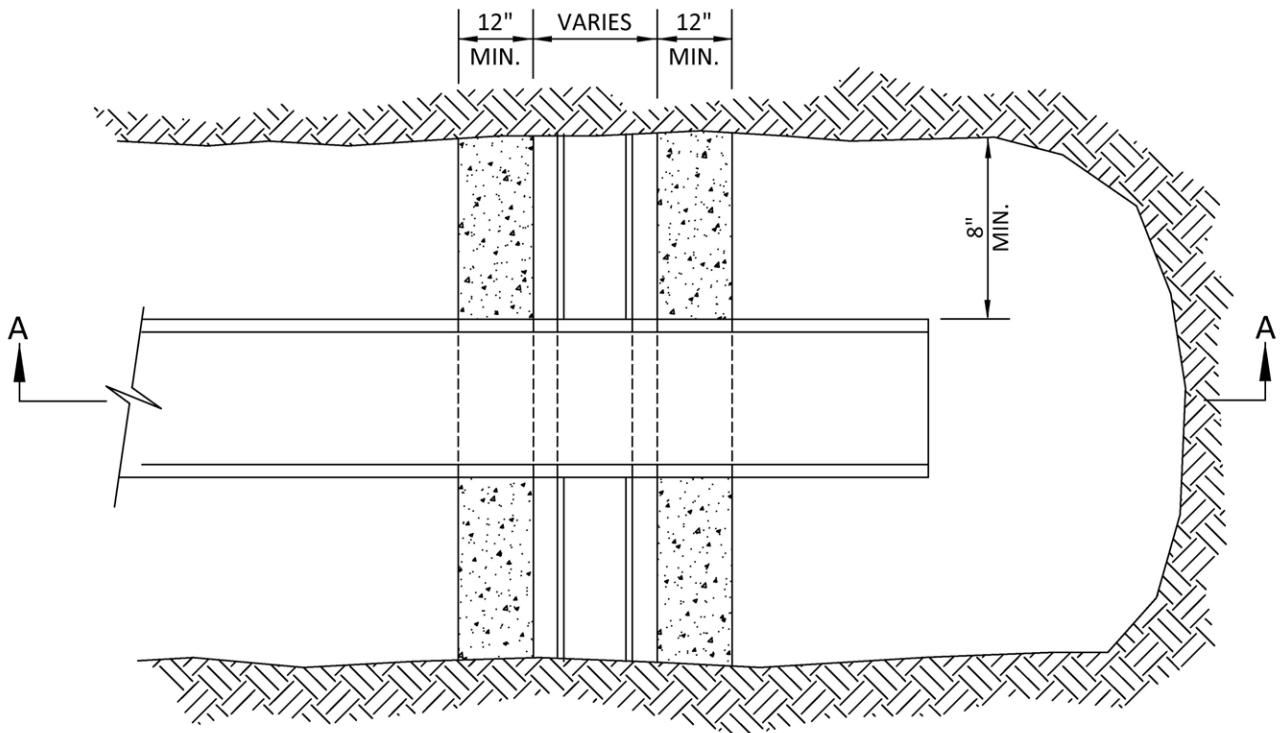
1 of 1

401-1

# STANDARD



**SECTION A-A**  
NOT TO SCALE



**PLAN VIEW**  
NOT TO SCALE



*David A. Schell*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

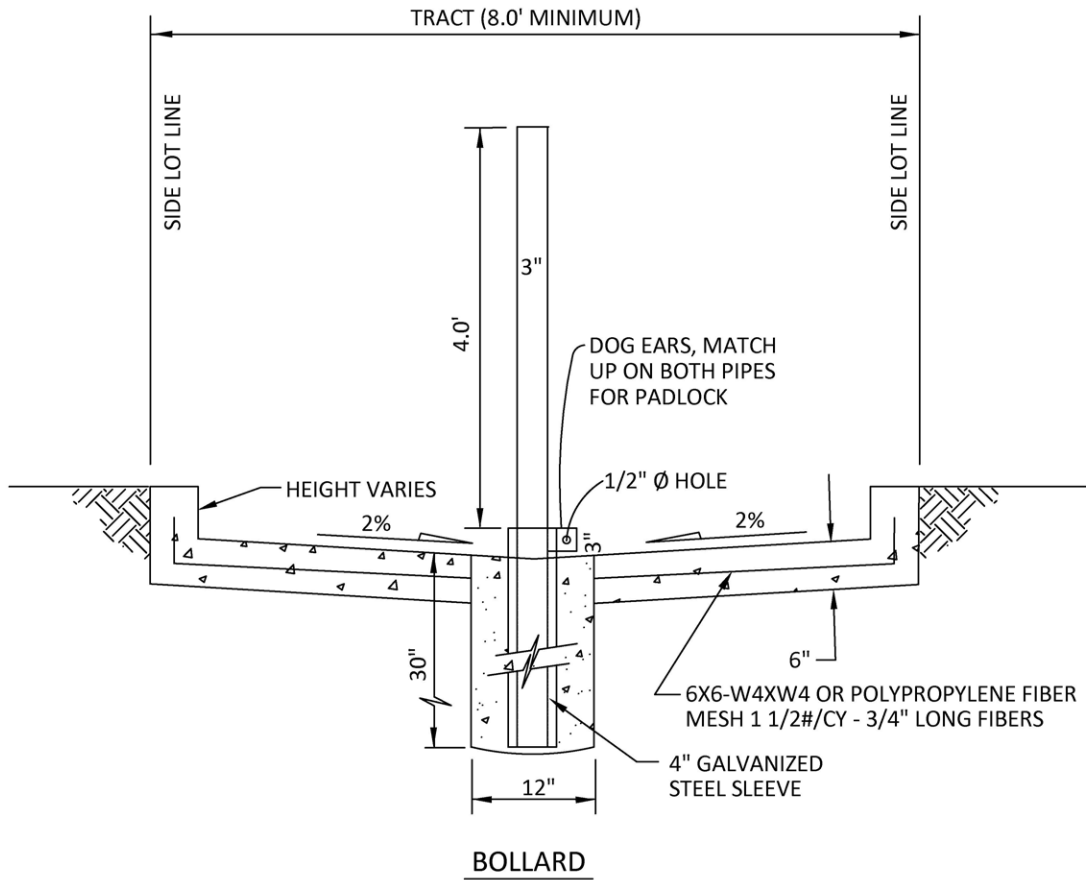
09/23/2019  
DATE

**STORM SEWER DETAIL:  
WATER or SEWER CROSSING**

1 of 1

**402-1**

# STANDARD



1. AT NO TIME SHALL THE DISTANCE BETWEEN BOLLARDS BE GREATER THAN 5'.
2. ALL BOLLARDS, EXCEPT FOR REMOVABLE POST, SHALL BE FILLED WITH CONCRETE.
3. ALL BOLLARDS SHALL BE GALVANIZED STEEL.
4. BOLLARDS ARE TO BE SET 5' TO 7' BACK OF SIDEWALK.
5. CHANNEL WIDTH = TRACT WIDTH (UNLESS OTHERWISE APPROVED.)



*David A. Kachell*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

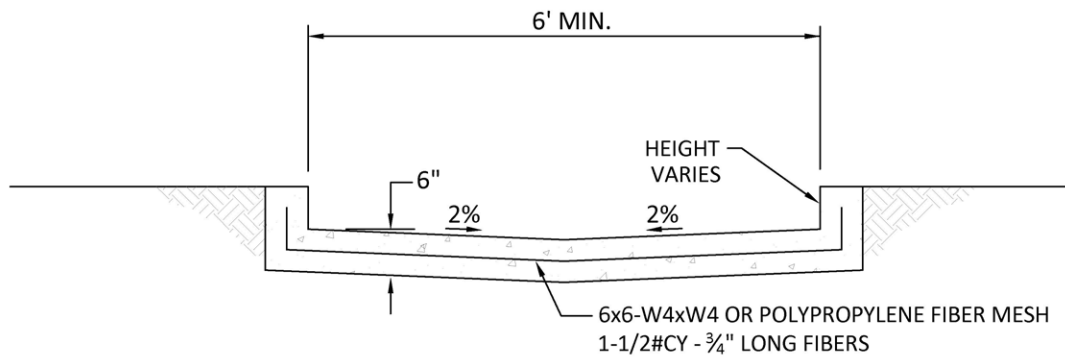
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DATE

TYPICAL CONCRETE  
DRAINAGE PAN

1 of 1

403-1

# STANDARD



A) 0.4% MINIMUM LONGITUDINAL SLOPE



*David A. Reubels*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

09/23/2019  
DATE

LOW FLOW CHANNEL

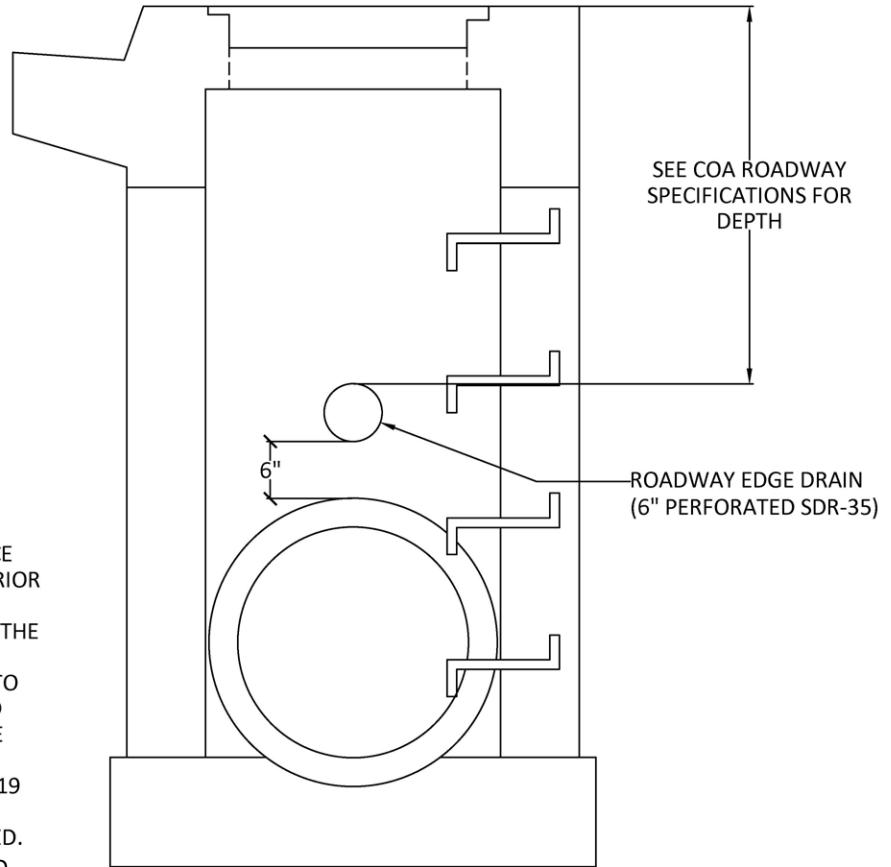
1 of 1

404-1

# STANDARD

## NOTES:

1. CONNECTION SHALL BE CORED INTO EXISTING INLET WALL AND NON SHRINK GROUT PLACED AROUND SDR-35.
2. IF INLET IS TO BE CAST IN PLACE, CONTRACTOR HAS THE OPTION TO PLACE SDR-35 BLOCKOUT WITHIN THE WALL PRIOR TO PLACING CONCRETE.
3. WATERSTOP GASKET SHALL BE USED AT THE CONNECTION.
4. FOR EDGE DRAINS RUNNING PARALLEL TO STORM, A MINIMUM OF 6" IS REQUIRED BETWEEN BOTTOM OF EDGE DRAIN PIPE AND TOP OF STORM PIPE.
5. SEE COA ROADWAY SPECIFICATIONS S1.19 FOR EDGE DRAIN CONSTRUCTION.
6. LOCATION OF STEPS TO BE COORDINATED.
7. EDGE DRAIN TO BE NON-PERFORATED WITHIN 5 FEET OF TIE-IN STRUCTURE AND A CUTOFF WALL SHALL BE PROVIDED 5 FEET UPSTREAM OF THE TIE-IN.



## TYPICAL END VIEW

REFER TO DETAIL 400-5 FOR  
REINFORCING INFORMATION AND  
NOTES



*David A. Reckh*  
CITY ENGINEER

09/25/2019  
DATE

*Vernon A. Adam*  
AURORA WATER

09/23/2019  
DATE

ROADWAY EDGE  
DRAIN CONNECTION  
TO TYPE 'R' INLET

1 of 1

405-1

## Appendix B



### Approved Products List

<b>AURORA WATER</b> <b>APPROVED PRODUCTS LIST (APL)</b> Last Updated: September 20, 2019			
MATERIAL DESCRIPTION	APPROVED MANUFACTURER	PERFORMANCE SPECIFICATION AND/OR MODEL	ITEMS SELECTED
<b>100 SERIES – GENERAL</b>			
<b>101 MANHOLES AND APPURTENANCES</b>			
<b>101.1 PRECAST MANHOLE BASES AND VAULTS</b>  NOTE: Meets ASTM C478 and C913 AASHTO HS-20 Loading	Copeland Precast	Base	
	Forterra	Base & channel poured monolithic	
	Lindsay Precast	Base & precast channel	
	Rinker	Base	
	Oldcastle / Colorado Precast	Base	
<b>101.2 STANDARD RINGS AND COVERS</b>  NOTE: Cast Iron ring and covers shall meet ASTM A126, Class B  All ring and covers located in traffic shall be solid and meet AASHTO HS-20 loading	Neenah (Cast Iron)	Model R-1706 (24" Ø), R-1741-D (36" Ø w/ 22" Ø offset), R-1758-C Frost Retardant (24" Ø), R-1798 (30" Ø) Slab Construction: Model R-1706-1S (24" Ø)	
	D & L Supply Co. (Cast Iron)	Slab Construction: Model A-1166 (24" Ø), A-1161 ((24" Ø, Private MH's Only)	
	<b>12.5" Ø Composite Lid (3/4" and 1" Meters)</b>		
	DFW Plastics	Model DFW12ACO-1WT AURORA-LID	
	Nicor	Model 13.0PAURthO - Castings/Denver – BLK	
	Trumbull	Model 4776	
	<b>23.75" Ø Composite Lid (&gt;1" Meters)</b>		
	Trumbull	Model 4315 (Solid), 4316 (1-Hole), 4317 (2-Hole) Composite Frame Model 367-5623	
	Neenah (Cast Iron)	Model R-6464-F, Slab Construction: Model R-6461-GH	
	Neenah (Cast Iron)	Model R-1926-7 with Type J-T Handle Bar Lock	
<b>101.3 WATERTIGHT RINGS AND COVERS</b>  <b>101.4 LOCKABLE MANHOLE LIDS</b>  <b>101.5 ADJUSTABLE SLOPE MANHOLE RINGS</b>	East Jordan Iron Works	Cast Iron Manhole Sloped Risers (AASHTO HS-20 loading)	
		Adjustable HDPE (AASHTO HS-20 loading)	
<b>102 GASKETS AND SEALS</b>			
<b>102.1 PIPE PENETRATION GASKETS</b>	Trelleborg Kor-N-Seal	106-406 Series (Sanitary & Storm) & 506 Series (Storm), ASTM C923	
	Press Seal Corporation	PSX connectors, ASTM C923	
	Hamilton Kent	Tylox 3SPW push-fit connectors, ASTM C923	
	A-Lok Products	A-Lok, Z-Lok, Quik-Lok, ASTM C923	
<b>102.2 PREFORMED FLEXIBLE JOINT SEALANTS FOR CONCRETE PIPE, MANHOLES, AND PRECAST BOX SECTIONS</b>	Trelleborg Kor-N-Seal	750 Sealingstrip, ASTM C990	
	Hamilton Kent	Kent Seal No. 2 Butyl Rubber Sealant, ASTM C990	
	Henry Company	RN101 Ram-Nek Preformed Flexible Plastic Strips, ASTM C990	
	ConSeal Concrete Sealants	CS-202 Butyl Rubber Sealant, ASTM C990	
<b>102.3 PREFORMED RUBBER GASKETS FOR CONCRETE MANHOLES</b>	Trelleborg Kor-N-Seal	170 Pre-Lube Hinge ASTM C443 and ASTM C1619	
	Hamilton Kent	TSS Series Tylox SuperSeal gasket, ASTM C443 and ASTM C1619	
<b>103 LININGS AND COATINGS</b>			
<b>103.1 CORROSION PROTECTIVE LININGS</b> NOTE: For new construction or re-lining non-structural applications.  Surface shall be prepared in accordance with ASTM D4259 standard practice for preparation of concrete by abrasion prior to coating application.  For structural repairs, please contact Aurora Water Engineering for minimum cementitious base thickness requirements.	<b>EPOXY BASED</b>		
	Raven Lining Systems	Raven 405, minimum thickness shall be 80 mils	
	Tnemec Company	Perma-Glaze Series 435, minimum thickness shall be 80 mils	
	Environmental Coatings	Sewer Shield 150-Sprayable, minimum thickness shall be 80 mils	
	Sauereisen	SewerGard 210-Sprayable, minimum thickness shall be 60 mils	
	<b>POLYUREATHANE BASED</b>		
	SpectraShield	TLS for Wastewater Structures, minimum thickness shall be 500 mils	
	SprayRoq	SprayWall, minimum thickness shall be 500 mils	
	<b>104 NON-SHRINK GROUT, CEMENT MORTAR, CONCRETE</b>		
	BASF Master Builders Solutions	MasterFlow 100, ASTM C1107	
<b>104.1 NON-METALLIC, NON-SHRINK, AND CEMENT-BASED GROUT</b> NOTE: Minimum 28 day compressive strength 4000 psi	Dayton Superior	1107 Advantage Grout, ASTM C1107	
	Quikrete	Commercial Grade FastSet Repair Mortar, ASTM C928	
<b>104.2 CEMENT MORTAR</b> NOTE: Minimum 28 day compressive strength 4000 psi	US Mix	Quickset (Vert. & Over), ASTM C928	
	Sika	SikaQuick VOH, ASTM C928	
<b>104.3 CONCRETE</b> NOTE: Minimum 28 day compressive strength 4000 psi	Sakrete	High Strength Concrete Mix, ASTM C387	
	Quikrete	Concrete Mix 1101, ASTM C387	
<b>105 CASING SPACERS AND SEALS</b>			
<b>105.1 CASING SPACERS</b> NOTE: Spacer to be provided on each side of pipe joint. Maximum spacing between spacers is eight feet along pipe barrel.	CCI Pipeline Systems	CCI Stainless Steel Band Casing Spacer Model CSS12	
	The Ford Meter Box Company	Uni-flange Casing Spacers	
	Cascade Waterworks	Stainless Steel Model CCS	
	Advance Products & Systems	Stainless Steel Model SSI	
	PowerSeal Pipeline Products	4810 Type 304 (18-8) Stainless Steel	
	BWM Company	Stainless Steel Model BWM-SS	
<b>105.2 CASING END SEALS</b>	CCI Pipeline Systems	CCI Model ESC Pull-on	
	Cascade Waterworks	Model CCES	
	Advance Products & Systems	Model AC Pull-on OR Model AM	
	BWM Company	Model BWM-PO	
	Pipeline Seal and Insulator (PSI)	Model C (Max Casing Diameter & Length 36" / 300 LF)	



MATERIAL DESCRIPTION	APPROVED MANUFACTURER	PERFORMANCE SPECIFICATION AND/OR MODEL	ITEMS SELECTED
<b>106 MISCELLANEOUS</b>			
<b>106.1 FOAM INSULATION</b>	DOW	Styrofoam Highload 100	
	Amoco Foam Products	Amofoam-RCY	
	Owens Corning	Foamular 400 or 404	
<b>106.2 ELECTRONIC UTILITY MARKERS</b>  <i>NOTE:</i> Mid-range markers allowed by Inspector approval only  If buried depth is greater than 8ft, proposed markers must be approved by Aurora Water Engineer or Inspector.	<b>3M</b>		
	Water	Blue 1252 Full-range (8ft bury depth), Mid-range 1403-XR Ball (5ft bury depth)	
	Wastewater	Green 1253 Full-range (8ft bury depth), Mid-range 1404-XR Ball (5ft bury depth)	
	Storm	Purple 1248 Full-range (8ft bury depth), Mid-range 1408-XR Ball (5ft bury depth)	
<b>200 SERIES - WATER SYSTEM</b>			
<b>201 PIPE AND FITTINGS</b>			
<b>DUCTILE IRON PIPE (DIP)</b>			
<b>201.1 DUCTILE IRON PIPE (DIP)</b> <i>NOTE:</i> 16" and Smaller shall be Pressure Class 350 psi Greater than 16" up to 36" shall be Pressure Class 250psi  See section 12.03.1 Thickness Class Design of Pipe for minimum nominal wall thickness (Class 52).  <u>See section 204.6 V-BIO POLYETHYLENE ENCASEMENT for required corrosion protection</u>	American Ductile Iron Pipe Co.	Fastite, AWWA C151/A21.51, C150/A21.50 (4"- 36")	
	U.S. Pipe	Tyton, AWWA C151/A21.51, C150/A21.50 (4"- 36")	
	McWane / Pacific States	Tyton, AWWA C151/A21.51, C150/A21.50 (4"- 36")	
<b>201.2 DUCTILE IRON MJ FITTINGS</b> <i>NOTE:</i> 16" and Smaller shall be Pressure Class 350 psi Greater than 16" up to 36" shall be Pressure Class 250psi	Tyler Union	AWWA C153/ A21.53 C111/A21.11 (4-36")	
	Star Pipe Products	AWWA C153/ A21.53 C111/A21.11 (4-36")	
	Serampore Industries (SIP)	AWWA C153/ A21.53 C111/A21.11 (4-36")	
	Sigma	AWWA C153/ A21.53 C111/A21.11 (4-36")	
	U.S. Pipe	AWWA C153/ A21.53 C111/A21.11 (4-36")	
<b>201.3 DUCTILE IRON RESTRAINED JOINT PIPE &amp; RESTRAINTS</b>  <i>NOTE:</i> 16" and Smaller shall be Pressure Class 350 psi Greater than 16" up to 36" shall be Pressure Class 250psi	<b>RESTRAINED JOINT PIPE</b>		
	U.S. Pipe	TR Flex (4"-36") and Field Lok 350 (4"-24")	
	<b>JOINT RESTRAINTS</b>		
	EBAA Iron	Megalug Series 1700, ASTM A536 (4"- 36")	
	Star Pipe	Stargrip Series 3100P and 3100S, ASTM A536 (4-36")	
	Romac Industries	RomaGrip, ASTM A536 (4"-36")	
	<b>MECHANICAL JOINT RESTRAINTS</b>		
	EBAA Iron	Megalug Series 1100, ASTM A536 (4"- 36")	
	Ford	Uni-Flange Series 1400, ASTM A536 (4"- 36")	
	Star Pipe	Series 3000, ASTM A536 (4-36")	
	Sigma Corporation	One-Lok SLCE Series, ASTM A536 (4"- 36")	
<b>POLYVINYL CHLORIDE (PVC) C900 PIPE</b>			
<b>201.4 POLYVINYL CHLORIDE (PVC) C900 PIPE</b> <i>NOTE:</i> Meets NSF/ANSI 61 and Color is Blue* 16" and Smaller shall be Pressure Class 305psi DR 14 Greater than 16" shall be Pressure Class 235psi DR 18  *Color Green is required for Wastewater *Color Purple is required for Reclaimed	North American Pipe Corp. (NAPCO)	AWWA C900/C605, ASTM D1784/D3139/F477 (4"-24")	
	Diamond Plastics Corporation	AWWA C900/C605, ASTM D1784/D3139/F477 (4"-12")	
	JM Eagle	Blue Brute, AWWA C900/C605, ASTM D1784/D3139/F477 (4"-12")	
	VinylTech / Northern Pipe	AWWA C900/C605, ASTM D1784/D3139/F477 (4"-24")	
<b>201.5 PVC C900 RESTRAINED JOINT PIPE &amp; RESTRAINTS</b>  <i>NOTE:</i> Meets NSF/ANSI 61 and Color is Blue* Meets AWWA C900/905, C111/A21.11, and ASTM D1784/D3139/F477 16" and Smaller shall be Pressure Class 305psi DR 14 Greater than 16" shall be Pressure Class 235psi DR 18  *Color Green is required for Wastewater *Color Purple is required for Reclaimed  Fusible C900 PVC will be approved on a case by case basis by Aurora Water Engineering.	<b>RESTRAINED JOINT PIPE</b>		
	North American Pipe Corp. (NAPCO)	RJ/RJB Certa-Lok (4"-24")	
	JM Eagle	Eagle Loc 900 (4"-16")	
	Diamond Plastics Corporation	Lok-21 (4"-24")	
	<b>JOINT RESTRAINTS</b>		
	EBAA Iron	Series 1500, ASTM A536 (4"-12")	
	Ford	Uni-Flange Restraint 1390-C-x-Q-U/I (4"-12")	
	Star Pipe	Series 1100 ASTM A536 (4"-36")	
	Sigma Corporation	PV-Lok Model D-PWP, ASTM A536 (4"-36")	
	<b>MECHANICAL JOINT RESTRAINTS</b>		
	EBAA Iron	Series 2000PV, ASTM A536 (4"- 36")	
	Ford	Uni-Flange Series 1500, ASTM A536 (4"- 36")	
	Star Pipe	Series 4000, ASTM A536 (4-36")	
	Sigma Corporation	One-Lok SLCE Series, ASTM A536 (4"- 36")	
<b>STEEL PIPE</b>			
<b>201.6 BOLTED COUPLINGS FOR STEEL PIPE</b>  <i>NOTE:</i> Meets AWWA C111, C200, 203, 205, 206, 208, 219 and AWWA Manual M11.	Trupply	Style 38 Coupling (4"-36")	
	Romac Industries	Styles XR501, 501 & Alpha (4"-24")	
	Smith-Blair	Model 411 Coupling (4"-36")	
	JCM Industries	200 Series Coupling (4"-36")	

MATERIAL DESCRIPTION	APPROVED MANUFACTURER	PERFORMANCE SPECIFICATION AND/OR MODEL	ITEMS SELECTED
<b>202 VALVES</b>			
<b>202.1 TAPPING VALVES</b> ( <i>Resilient Wedge, FL/MJ</i> )	American AVK	Model 45 (4"-12")	
<b>NOTE:</b> Ductile Iron per ASTM A536 Meets AWWA C509 / C515 Minimum Rated 250 PSI Full Port, Open RT	American Flow Control	Model 2500 (4"-12")	
	Mueller Co.	Model 2361 (4"-12")	
	Kennedy	Model KS-FW 8950SS (4"-12")	
	Crispin	(4"-12")	
	Clow Valve Co.	Model 2639 F-6114 (4"-12")	
<b>202.2 GATE VALVES</b> ( <i>Resilient Wedge, MJ/MJ</i> )	American AVK	Model 45 (4"-16")	
<b>NOTE:</b> Ductile Iron per ASTM A536 Meets AWWA C509 / C515 Minimum Rated 250 PSI Full Port, Open RT	American Flow Control	Model 2500 (4"-12")	
	Mueller Co.	Model 2361 (4"-12")	
	Kennedy	Model KS-FW 8571SS (4"-12")	
	Crispin	(4"-16")	
	Clow Valve Co.	Model 2639 F-6100 (4"-12")	
<b>202.3 DOUBLE-DISC GATE VALVES</b>	Clow Valve Co.	Model F-5065(4-12")	
<b>NOTE:</b> Ductile Iron per ASTM A536 or Cast Iron per ASTM A126, Class B Meets AWWA C500 Minimum Rated 200 PSI Full Port, Open RT	Kennedy	Model F-5065 (4"-12")	
	Crispin/K-Flow Valves	(4"-12")	
<b>202.4 BUTTERFLY VALVES</b> (BFV)	Henry Pratt Co.	HP250II (16"-36")	
<b>NOTE:</b> Ductile Iron per ASTM A536 Stainless Steel Shaft Meets AWWA C504 Class 250B Minimum Rated 250 PSI Full Port, Open RT	Clow Valve Co.	Series 1450, 4500 (16"-36")	
	Mueller Co.	Lineal XP11 Class (16"-36")	
	Valmatic	Series 2300 (16"-36")	
	Crispin/K-Flow Valves	Series 47 (24"-36")	
	DeZurick	Model BAW (16"-36"), Model BOS-US Resilient Seated (16" Only)	
<b>202.5 AIR &amp; VACUUM RELEASE VALVES</b>		Apco	
<b>NOTE:</b> Meets AWWA C512		Valmatic	
		ARI	
		Crispin Valves (C series & AL series)	
		Vent-O-Mat	
<b>202.6 PRESSURE REDUCTION VALVES</b> (PRV)	Cla-Val Co.	Model 90-01 w/ 100-01 Hytrol Main Valve (FL/FL, Globe, 4"-36")	
<b>NOTE:</b> Ductile Iron per ASTM A536 Meets AWWA C530 Minimum Rated 250 PSI Full Port, PRV Size to be specified on Civil Plans			
<b>202.7 CHECK VALVES</b>	Cla-Val Co.	Distribution System Only: Model 81-02 w/ 100-01 Hytrol Main Valve (FL/FL, Globe, 4"-24") Services Only: Series 584 Flex-Check Valve (FL/FL 2"-12")	
<b>NOTE:</b> Distribution system requires cushion check valves; on services, swing check valves are acceptable. Meets AWWA C508 Minimum Rated 250 PSI (System) 175 PSI (Services)	VAG USA / GA Industries	Services Only: Model 200-D (FL/FL 2"-12")	
	American Flow Control	Distribution System and Services: Series 2100 (FL/FL 2"-16") Services Only: Swing Gravity Series 600 and 52-SC (FL/FL 4"-12")	
	Mueller Co.	Distribution System and Services: Model 851A (FL/FL 2"-24") Services Only: Swing Gravity Model A-2600-6-02BB (FL/FL 2"-12")	
<b>202.8 VALVE BOXES WITH DROP LID</b>	Tyler Union	Model 6850, 6860 with #6 Base	
<b>NOTE:</b> Cast Iron per ASTM A48 Class 35 Meets HS-20 Traffic Loading Installed per AWWA M44	East Jordan Iron Works	Model 8550, 8560	
	Castings	Model 6860	
	Star Pipe	Model VB-0002.VB-0006	
	Sigma	Model VB261, VB630	
<b>202.9 VALVE BOX ADAPTORS</b>	Adaptor	Valve Box Adaptor II	
<b>202.10 EXTENDED OPERATORS</b>	Limitorque	21" radius, for manual & motorized valve control	
	MDT	21" radius, for manual & motorized valve control	
	Valmatic	21" radius, for manual & motorized valve control	
	EIM	21" radius, for manual & motorized valve control	
	Rotork	21" radius, for manual & motorized valve control	
	DeZurick	21" radius, for manual & motorized valve control	

MATERIAL DESCRIPTION	APPROVED MANUFACTURER	PERFORMANCE SPECIFICATION AND/OR MODEL	ITEMS SELECTED
<b>203 WATER SERVICES</b>			
<b>203.1 TAPPING SADDLES (6"-12" X ¾"-2")</b>  <i>NOTE:</i> <i>Meets AWWA C800</i>	A.Y. McDonald	Model 3825 (DIP, AC, CI, 3805 (PVC)	
	Ford	Model 202B (DIP, AC), S90 Style B (PVC)	
	Mueller Co.	Model BR2B (DIP, AC, CI), H-13000/OD Series (PVC)	
	PowerSeal	Model 3407 (DIP, AC, CI, PVC)	
<b>203.2 CTS CORPORATION STOPS (3/4" TO 2")</b>  <i>NOTE:</i> <i>Meets AWWA C800</i> <i>AWWA Taper Inlet x Conductive Compression (CC)</i> <i>Connection with stainless steel retainer ring and positive stop.</i>	A.Y. McDonald	Model 74101BQ	
	Ford	Model FB1000-XX-Q-NL	
	Mueller Co.	Model B2500810N	
<b>203.3 CTS CURB STOPS (3/4" TO 2")</b>  <i>NOTE:</i> <i>Meets AWWA C800</i> <i>CC X CC connection with stainless steel retainer ring and positive stop.</i>	A.Y. McDonald	Model 76100Q	
	Ford	Model B44-XXX-Q-NL	
	Mueller Co.	Model B-25209N	
<b>203.6 CURB STOP BOXES</b>  <i>NOTE:</i> <i>Meets AWWA C800</i> <i>Cast Iron per ASTM A48, Class 2</i>	A.Y. McDonald	Model 5614 (3/4" / 1"), 5615 (1 ½" / 2")	
	Ford	Model EM2-50-56 (3/4" / 1"), EM2-50-57 (1 ½" / 2")	
	Mueller Co.	Model H-10300 (3/4" / 1"), H-10300-990002 (1 ½" / 2")	
	Tyler Union	Model Box # 95E (3/4"to 1 ½"), Enlarged Base (2")	
<b>203.8 CTS SERVICE LINE COUPLINGS (3/4" TO 2")</b>  <i>NOTE:</i> <i>Meets AWWA C800</i> <i>CC X CC connection with stainless steel retainer ring and positive stop.</i>	A.Y. McDonald	Model 74758Q	
	Ford	Model C44-XX-Q-NL	
	Mueller	Model H15403N	
<b>203.9 CTS STOP AND WASTE VALVES (3/4" TO 2")</b>	A.Y. McDonald	Model 76000Q	
	Ford	Model B44-XXXSW-Q-NL (1 ½" and 2" Only)	
	Mueller	Model B25219N	
<b>203.10 CTS METER SETTERS – (3/4" TO 2")</b>  <i>NOTE:</i> <i>Meets AWWA C800</i> <i>CC X CC connection with stainless steel retainer ring and positive stop.</i>	A.Y. McDonald	Model 731-2--WDQQ 33 (5/8" x 3/4") Model 731-3--WDQQ 33 (3/4" x 3/4") Model 731-4--WDQQ 44 (1" x 1") Model 721B612WWQQ 665 (1 ½" x 1½") Model 721B712WWQQ 775 (2" x 2")	
	Ford	Model VBHH72-12W-44-33-Q-NL (5/8" x 3/4") Model VBHH73-12W-44-33-Q-NL (3/4" x 3/4") Model VBHH74-12W-44-44-Q-NL (1" x 1")	
	Mueller	Model B-2474-2N (5/8", 3/4", 1")	
<b>204 CORROSION PROTECTON</b>			
<b>204.1 POST MOUNTED TEST STATIONS</b>	Farwest Corrosion Control Co.	Testox CP Test Stations by Gerome Series 700 Pipe Mounted Test Station (1 ¼" Threaded)	
<b>204.2 SPRAY PRIMER</b>	Farwest Corrosion Control Co.	Royston Roybond 747	
<b>204.3 WELD CAPS</b>  <i>Meets AWWA C-209</i>	Farwest Corrosion Control Co.	Royston Handy Cap IP	
	Farwest Corrosion Control Co.	Tapecoat H35 Gray Tape	
	Canusa-CPS	Melt stick (MS)	
	Canusa-CPS	Coating Repair Patch (CRP)	
<b>204.4 HEAT SHRINK SLEEVES</b>	Canusa-CPS	Model GTS-HT (High Temperature Corrosion Protection and Mechanical Resistance), GTS-PP-65 (Mechanical Resistance Only)	
<b>204.5 STEEL PIPE COATINGS</b>  <i>Meets ASTM G 95</i>	IrathaneFutura (ITW)	Protec II	
	LifeLast	Durashield DS310-61	
	Trenton	Primer and Wax Tape	
	Denso	Primer and Wax Tape	
<b>204.6 V-BIO POLYETHYLENE ENCASEMENT</b>  <i>Meets ANSI/AWWA C105/A21.50</i> <i>Minimum Thickness is 8 Mil</i>	American Ductile Iron Pipe Co.	V-BIO Polywrap	
	U.S. Pipe	V-BIO Polywrap	
	McWane / Pacific States	V-BIO Polywrap	

MATERIAL DESCRIPTION	APPROVED MANUFACTURER	PERFORMANCE SPECIFICATION AND/OR MODEL	ITEMS SELECTED
204.7 POLYVINYL CHLORIDE TAPE	Farwest Corrosion Control Co.	Polyken #900	
	3M Company	Scotchwrap Tape #50	
205 OTHER			
205.1 FIRE HYDRANTS (5 ¼" MAIN VALVE)  NOTE: Color is Safety Yellow Ductile Iron per ASTM A536 / C151 Meets AWWA C502 / C550 Minimum Rated 250 PSI	Mueller Co.	Model A-403 Centurion 350	
	American Flow Control	Model Waterous Pacer WB67-250	
	Clow Valve Co.	Model Admiral Hydrant 350	
205.2 AUTOMATIC FLUSHING DEVICE (2")  NOTE: Minimum Rated 150 PSI	Kupferle	Model Eclipse #9800 (Cold Climate)	
205.3 SAMPLING STATION	Kupferle	Model MainGuard #66 (Cold Climate)	
205.4 FOSTER ADAPTOR  NOTE: Meets AWWA C111 and C153	Infact	MJ X MJ Restraint Adaptor (4-24")	
	Star Pipe	Series 100 MJ x MJ Restraint Adaptor (4-12")	
205.5 SWIVEL Adapters  NOTE: Meets AWWA C111 and C153	Tyler Union	Swivel Adapter	
	Sigma	Swivel Adapter	
	Star Pipe	Swivel Adapter	
205.6 METER PITS (3/4" / 1")  NOTE: Concrete meter pits shall meet ASTM A48	Oldcastle Enclosure Solutions	Model 00241001-0024-48 B-Body B-W 2MSHL (24" Ø Plastic)	
	Forterra	24" I.D. Concrete, sections must be provided in 1 ft sections.	
205.7 DOUBLE CHECK DETECTOR ASSEMBLIES  NOTE: Meets AWWA C510 and C515 Approved by UL & FM Outside stem and yoke (OS&Y) resilient seated gate valves  Minimum Rated 175 PSI	Zurn / Wilkins	Model 350DA (4"-10")	
	Watts Regulatory Co.	Model 774 DCDA-OSY (4"-10")	
	FEBCO	Model MasterSeries LF876V (4"-10")	
	Ames Fire & Waterworks	Model Colt C300, Model 3000SS (4"-10")	
	2" DOUBLE CHECK DETECTOR ASSEMBLIES		
	Watts Regulatory Co.	Model 007M1DCDA	
	Ames Fire & Waterworks	Model 3000B	
	Zurn / Wilkins	Model 950 LXLTDA	
205.8 PIPE CLAMPS	National Pipe Hanger	Heavy Duty Two-Bolt Pipe Clamp (Stainless Steel or Electro-Galvanized Carbon Steel)	
	PHD Manufacturing	4-Bolt Underground Pipe Clamp Part #590 (Electro-Galvanized)	
205.8 PIPE CLAMPS	A.Y. McDonald	Model 40MJ07PVC	
	Ford	Model IDLER-X-NL	
	Mueller Co.	Model H-10887	
300 SERIES - SANITARY SEWER SYSTEM			
301 PIPE			
301.1 POLYVINYL CHLORIDE (PVC) PIPE  NOTE: Meets ASTM D3034-SDR35 (4"-15") ASTM F679 (18"-27")  SDR 35 for Depths < 15' SDR 26 for Depths >15' and <20' C900 for Depths >20'  Force Mains will be reviewed on a case-by-case basis by Aurora Water Engineering.	North American Pipe Corp. (NAPCO)		
	Diamond Plastics Corporation		
	JM Eagle		
	VinylTech / Northern Pipe		
301.2 STRUCTURE MARKERS	JS Contractor Supply Item No: UFP-TYPE 2 CRY5 (72" Yellow post with white sheeting)		
400 SERIES - STORM SEWER			
401 PIPE			
401.1 RCP / CBC  NOTE: Meets AASHTO M170, M242 ASTM C76, C655 or C361, ACI 318  Force Mains will be reviewed on a case-by-case basis by Aurora Water Engineering.	REINFORCED CONCRETE PIPE (RCP) / CONCRETE BOX CULVERT (CBC)		
	Lindsay Precast (CBC)		
	Forterra (RCP/CBC)		
	Rinker (RCP/CBC)		
	Oldcastle / Colorado Precast (RCP/CBC)		

All rubber gaskets and seal material shall be made of SBR (Styrene Butadiene Rubber) or EPDM (Ethylene Propylene Diene Monomer) Rubber, including PVC and DIP pipe joint gaskets.

All components in contact with potable water shall conform to NSF/ANSI 61 and NSF/ANSI 372, AWWA C800 and ASTM B584, UNS C89833 (latest revision)

## PROCEDURE FOR PRODUCT APPROVAL

1. Contractors, suppliers and manufacturers desiring to submit products for approval and inclusion in these Standards shall submit materials detailed below to the Aurora Water Warehouse at 13645 E. Ellsworth Ave., Aurora CO. 80012. Contractors, suppliers and manufactures wishing to visit warehouse supervisor in person shall first request an appointment by calling (303) 326-8500.
2. The City will complete its review within 90 days. Contractors, suppliers and manufacturers desiring to appeal the decision of the review committee shall submit an appeal to the Manager of Aurora Water Engineering within 30 days after the final decision by the review committee.
3. Aurora Water shall review the appeal and render a decision within 30 days. The decision of the Director will be final.
4. Contractors, suppliers and manufacturers desiring to submit materials for approval and inclusion in these Standards shall submit the following minimum information:
  - a Manufacturer's standard drawings, schematics and diagrams:
    - i Description of the material or equipment for which the supplier or manufacturer desires to be considered.
    - ii Delete information not applicable to the submittal.
    - iii Supplement standard information to provide information specifically applicable to the material or equipment.
    - iv Detailed operation and maintenance and disassembly information for maintenance if applicable.
    - v Applicable standards, such as ASTM or Federal Specification numbers.
    - vi Manufacturer's name, type and model number of equipment.
    - vii Drawings, catalogs or parts thereof, manufacturer's specifications and data, instructions, performance characteristics and capacities, and other information specified or necessary.
    - viii Parts, devices, controls and accessories forming a part of equipment.
    - ix Descriptive literature for paint and coating systems.
    - x Description of where parts may be ordered and anticipated time for delivery of parts.

- b Manufacturer's warranties.
- c Format.
  - i Present in a clear and thorough manner.
  - ii Minimum sheet size: 8 1/2"x11".
  - iii Clearly mark each copy to identify pertinent products and models.
  - iv Individually annotate standard drawings which are furnished, cross out items that do not apply, describe exactly which parts of the drawing apply to the equipment being considered.
  - v Individually annotate catalog sheets to identify applicable items.
  - vi Clearly identify the Supplier and Manufacturer along with addresses, telephone number and person to contact for additional information.

# Appendix C



## **Rules and Regulations Governing Wastewater Control**

Rule and Regulations propagated pursuant to City of Aurora Code of Ordinances  
Chapter 138 Article VI Section 138-263

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# Rules and Regulations Governing Wastewater Control

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## **I. General Information and Definitions**

### **A. Authority**

These Rules and Regulations are issued by the General Manager of Aurora Water and the City of Aurora, Colorado (City), in accordance with, and are supplemental to Chapter 138 Article VI of the City of Aurora Municipal Code.

### **B. Effective Date**

The Wastewater Rules and Regulations are effective on and after January 1, 2012, and supersede all former Rules and Regulations governing wastewater control.

### **C. Purpose**

These Rules and Regulations set forth uniform requirements for direct and indirect contributors to the wastewater collection and treatment system of the City and enables the City to comply with all requirements of the Metro Wastewater Reclamation District (District), applicable state laws and the general pre-treatment regulations issued pursuant to the Clean Water Act of 1977.

### **D. Amendments**

These Rules and Regulations may be altered from time to time, and such alterations, changes, additions, or amendments shall be binding, and in full force effective as of the date of the filing and publication.

### **E. Severability**

In the event any provision of these Rules and Regulations or circumstances is held invalid, such invalidity shall not affect any other provision or application.

### **F. Definitions**

In addition to the definitions set forth in Chapter 138, Article VI, of the City of Aurora Municipal Code entitled "Wastewater Control" and as used in these Rules and Regulations; unless the context clearly indicates otherwise, the present words and expressions shall be defined as follows:

**Acid Neutralization Unit** - a vessel made in various sizes and filled to a specified level with an approved acid-neutralizing agent through which acidic liquid wastes can be passed for acid neutralization.

**Best Management Practices or BMPs** - schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to reduce pollutants.

**Commercial User** - any non-domestic source discharging Pollutants into a Publicly Owned Treatment Works (POTW). Industrial Users fall under the commercial use category.

**Drainage Fixture Unit** - a rating in terms of gallons per minute (GPM) representing the maximum amount of water which can drain from a fixture or piece of equipment in one minute. The value of one drainage fixture unit (DFU) is equal to 7.5 GPM.

**Flow Equalization Unit** - a structure or structures with equipment or attachments for the purpose of delaying, detaining, equalizing or otherwise controlling the flow or discharge of wastewater from a premise through a building sewer into a public sewer.

**FOG** - Fats, oils and grease

**Food Preparation Establishment** - a commercial business or institution where food is prepared and intended for individual portion service and includes the site at which the individual portions are provided, whether consumption occurs on or off the premises. Additionally includes all food manufacturing and packaging facilities.

**Grease Interceptor** - typically a two compartment pre-cast concrete tank, interceptors are normally located outside of the building. The second compartment shall have 1/3 total capacity of the tank.

**“In line” Grease Trap** - a prefabricated unit for trapping of fats, oil, grease and food solids. Typically installed inside of the building, flush with the finish grade and located outside of the food prep area.

**Metro, District or Metro District** - means the Metro Wastewater Reclamation District (District) located at 6450 York Street, Denver, Colorado 80229. Wherever approval or correspondence with the District is referred to, it shall mean the District Manager of the District unless otherwise specified.

**POTW or Publicly Owned Treatment Works** - means a treatment works which is owned in this by the Metro District or Aurora Water. This definition includes any devices or systems used in the collection, storage, treatment, recycling, and reclamation of sewage and any sewers conveying wastewater to the Metro District or Aurora Water treatment plant. For the purposes of these Rules and Regulations, POTW shall also include any sewers conveying wastewaters to the POTW from persons outside the District or the City of Aurora who are users of the District or Aurora Water POTW.

**POTW Treatment Plant** - means the portion of the POTW designed to provide treatment to wastewater.

**Pre-treatment Device** - means an apparatus or method used to treat or remove pollutants from the wastewater stream such as grease interceptors, sand/oil interceptors, acid neutralization tanks, flow equalization units, etc.

**Pre-treatment Requirement or Requirement** - means any substantive or procedural requirement related to pre-treatment, other than a Pre-treatment Standard imposed on an Industrial User directly permitted by the Metro District.

**Private Sanitary Sewer Service Line** - the building sewer from the foundation to the publically maintained sewer main, including the tapping saddle or tee on the main.

**Production Units** - Units of measurement of a product or industry.

**Sampling** - A periodic collection of wastewater as it flows through a public or private sewer conveyance system.

**Sand and Oil Interceptors** – typically a two compartment pre-cast concrete tank, interceptors are normally located outside of the building. The second compartment shall have 1/3 total capacity of the tank.

**Significant Industrial User** - Significant Industrial User means:

- (a) Any Commercial/Industrial User subject to Categorical Pre-treatment Standards under 40 CFR §403.6 and 40 CFR Chapter I, Subchapter N;
- (b) Any Commercial/Industrial User designated as such by the Metro District on the basis that the Commercial/Industrial User has a reasonable potential for adversely affecting District operations or for violating any Pre-treatment Standard or Requirement;
- (c) Any Commercial/Industrial User discharging an average of 25,000 gallons per day or more of process wastewater to the sanitary sewer system (excluding sanitary, non-contact cooling, and boiler blowdown wastewater); and
- (d) Any Commercial/Industrial User discharging a process waste stream which makes up five percent (5%) or more of the average dry weather hydraulic or organic capacity of the Metro District's treatment plant.

Upon a finding a Commercial/Industrial User meeting the criteria in Paragraph (a) above never discharges more than 100 gallons per day (gpd) of total categorical wastewater (excluding sanitary, non-contact cooling and boiler blowdown wastewater, unless specifically included in the Pre-treatment Standards) the Metro District may determine the Commercial/Industrial User a Non-significant Categorical Commercial/Industrial User if the following conditions are met:

1. The Commercial/Industrial User, prior to the Metro District's finding, has consistently complied with all applicable categorical pre-treatment standards and requirements;

2. The Commercial/Industrial User annually submits the certification statement required in 403.12(q) together with any additional information necessary to support the certification statement; and

3. The Commercial/Industrial User never discharges any untreated concentrated wastewater. Upon a finding a Commercial/Industrial User meeting the criteria in paragraphs (b), (c), or (d) above has no reasonable potential for adversely affecting the Metro District's operation or for violating any Pre-treatment Standard or Requirement, the District may at any time, on its own initiative or in response to a petition received from a Municipality or Commercial/Industrial User, determine such Commercial/Industrial User is not a Significant Industrial User.

**Testing** - The analysis of wastewater.

**Wastewater Control Ordinance** - Operating regulations for the control of the use of the Aurora Municipal Wastewater Collection System, Treatment System, and Storm Drainage System known as Chapter 138, Article VI of the City of Aurora Municipal Code.

**Wastewater Pre-treatment Facilities** - Structures, devices or equipment, such as Grease and Sand/Oil Interceptors or Flow Equalization Units for the purpose of neutralizing or removing deleterious wastes from wastewater generated from a premise prior to its discharge into a public sewer.

## **II. General Requirements**

### **A. Authority**

Notwithstanding the issue of any permit, the City of Aurora reserves the full power and authority to determine all matters in connection with the control and use of its Wastewater Collection and Treatment Systems. Furthermore the General Manager of Aurora Water shall have the authority to suspend, modify or revoke, with cause any such permit in accordance with Chapter 138 of the City of Aurora Municipal Code.

### **B. Commercial and Industrial Discharge Permits**

#### **1. Commercial Wastewater Discharge Permit**

All commercial and industrial users contributing to or proposing to connect to, or change the nature or amount of discharge to the POTW shall provide to the City a Commercial Wastewater Discharge Permit Applications and Questionnaire before connecting to or discharging to the POTW.

#### **2. Industrial Wastewater Discharge Permits**

Significant Industrial Users are required to obtain an Industrial Wastewater Discharge Permit with Metro in accordance with Article VI, Division 1, Chapter 138-291 of the City of Aurora Code.

### **3. Duration and Reissuance**

Commercial wastewater discharge permits may be issued for a specified term or an indeterminate period of time. Industrial wastewater discharge permits shall be issued for a specified term not to exceed five (5) years, and may be issued for a period less than a year or may be stated to expire on a specific date. Each user shall apply for permit reissuance at least one hundred eighty (180) days prior to the expiration of the user's current commercial or industrial Wastewater Discharge Permit.

### **4. Transferability**

Wastewater discharge permits are issued to a specific user for a specific operation. A wastewater discharge permit shall not be reassigned or transferred or sold to a new owner, new user, different premises, or a new or changed operation without prior notification to and approval by the appropriate issuing authority. A copy of the existing permit must be provided to the prospective transferee prior to such transfer.

### **5. Violation**

It shall be unlawful for any user to violate or fail to comply with any condition of a Wastewater Discharge Permit.

(Code 1979, § 39-105(a); Ord. No. 2000-26, § 1, 4-24-2000; Ord. No. 2005-74, § 1, 10-10-2005)

## **C. Review of Plans**

Location of pre-treatment facilities is reviewed with the Site Plan submittal to the Planning Department, and the Civil Plan submittal. Sizing of pre-treatment facilities is reviewed with the Building Plan submittal. If either of these submittals is not required, it is the responsibility of the generator and his/her contractor to contact Aurora Water Engineering for approval of the facility.

Aurora Water Engineering may request additional plans and information which may be needed to determine the impact on the wastewater collection system of the proposed waste(s) and the size of the wastewater pre-treatment facilities which may be required.

In the event it becomes necessary for the General Manager of Aurora Water to require an existing business or industrial user to install suitable wastewater pre-treatment and/or flow equalization units, a written explanation for the requirement shall be furnished to the owner or the authorized agent thereof. Such a requirement may arise when it becomes apparent waste discharged from the business or industry is in violation of the City Code and/or may cause harm to the public sewer system, persons entering the sewer system to perform maintenance, the treatment process, the POTW, and/or the environment. The request shall be based on one of the following determinations:

a) **Direct sampling.** Direct sampling shall be used wherever possible. A sample taken at a control structure shall be analyzed as prescribed by Chapter 138 of the Wastewater Control Ordinance.

b) **Comparisons.** When direct sampling is not possible, comparison with another similar

process, the composition and/or volume of the wastewater being known to be of a similar nature to of the business or industry in question, shall be used.

**Best Judgment.** Best judgment shall be made where it is not possible to sample and where a similar process to which a comparison does not exist. Best judgment shall be based on reasonable knowledge of the processes involved, the nature of the wastewaters produced by such processes and the amount of water consumption.

#### **D. City Notifications**

The owners of any establishment requiring a wastewater pre-treatment facility shall notify Aurora Water Engineering as follows:

A. Prior to the construction of a new business or facility requiring a wastewater pre-treatment device

B. Upon change or transfer in ownership of a business requiring a wastewater pre-treatment device

C. Upon a significant change in process and operations, including change in the menu of a food establishment resulting in a substantial increase the use and discharge to the wastewater collection system of fats, oil and grease, which otherwise changes the quantity, quality and/or content of wastewater discharges.

D. Upon any change in the type or size of such facility which would dictate a deviation from the plumbing plans.

E. Upon installation of the new wastewater pre-treatment facility prior to the water test of the plumbing system for onsite review and approval of the facility.

F. Upon the decommissioning or abandonment of an existing pre- treatment device.

#### **E. Discharge Limitations on Wastewater**

Wastewater shall not contain or exhibit the characteristics as set forth in Section 6 of the Metro Wastewater Reclamation District Rules and Regulations or as set forth in Article VI, Division 1, Chapter 138-263 of the City of Aurora Code. In the event here multiple discharge limitations exist for the same contaminant, the most stringent limitation shall apply.

Notwithstanding the provisions of this Section, the General Manager of Aurora Water may, on a case by case basis, require more stringent limitations in a wastewater discharge permit, issued to a particular user, to prevent interruptions of service, increased maintenance for the City, or any other interference with the operation of the system.

#### **F. Storm Sewer and Storm Drainage System Connections**

No direct physical connection from any storm drainage pipe or system shall be allowed into the wastewater collection system.

## **G. Abandonment of Wastewater Pre-treatment Devices**

1. In the event the use of a building changes where no wastewater pre-treatment of wastes is needed or required, the abandoned devices shall be pumped and cleaned of accumulated material and: Disconnected from service; removed from the ground and hauled away for proper disposal or: Disconnected from service, filled with sand or other approved material and bypassed.
2. As an abandoned wastewater pre-treatment device may constitute a danger to those in the area and/or the public sewer system, improper abandonment shall be considered a violation of Chapter 138 of Aurora Municipal Code and will be grounds for issuance of a Notice of Violation or Summons and Complaint by Aurora Water.
3. Proper abandonment shall be considered the responsibility of the present owner(s) or tenant(s).
4. All wastewater pre-treatment unit abandonment activities must be approved and inspected by Aurora Water Engineering Division.

## **H. Notification of Violations**

1. Failure to maintain any wastewater pre-treatment facility in efficient working condition shall constitute a violation of the Wastewater Control Ordinance Chapter 138.
2. Any unauthorized alteration or damage to any wastewater pre-treatment facility or method shall constitute a violation of the Wastewater Control Ordinance Chapter 138.
3. When a violation to the Wastewater Control Ordinance, these Rules and Regulations, Wastewater Discharge Permit or any applicable Code or Rules and Regulations is determined to exist, the General Manager of Aurora Water or his/her authorized agent shall issue to the responsible person a notice of violation. This notice shall contain at least the following:
  - A. The name of the person cited for the violation.
  - B. Location of the violation.
  - C. Details of the violation.
  - D. Corrective action to be taken by the cited person.
  - E. Time limit for the corrective action to be taken.
  - F. Penalty for non-compliance.
  - G. Statement on alternative immediate action available to the City in accordance with Chapter 138 of the Wastewater Control Ordinance.
4. Should the violation still exist after the time limit on the notice to comply has elapsed, the General Manager of Aurora Water or the authorized representative may invoke legal actions as provided for in Wastewater Control ordinance Chapter 138.



### III. Typical Grease Interceptors

All interceptors shall be installed in accordance with Detail #303, Appendix A; Standards and Specifications Regarding Water, Sanitary Sewer and Storm Drainage Infrastructure, latest revision.

#### A. Applicability

1. Grease Interceptors shall be required for all food preparation establishments (cafes, fast food outlets, pizza outlets, delicatessens, sandwich shops, coffee shops), animal slaughter houses, soap factories, tallow/fat rendering establishments, hide curing establishments, schools, nursing homes; and others establishments capable of discharging fats, oil and grease into the City of Aurora Sanitary Sewer Collection System.
2. Grease interceptors required by these rules and regulations shall be installed unless the City determines the installation of a grease interceptor would not be feasible due to space constraints. The facility bears the burden of demonstrating the installation of a grease interceptor is not feasible and the variance will not lead to violations of these rules and regulations. Any food preparation establishment granted a variance from a grease interceptor requirement shall implement Best Management Practices per these rules and regulations such that an equivalent level of treatment is achieved.
3. Grease interceptors will not be required for private residences or dwellings.

#### B. Materials and Structures

1. All interceptors shall be located outside, on private property whenever possible within thirty feet (30') of the facility served. The location of a food establishment above the first floor of its respective building shall not be considered sufficient reason to eliminate the requirement for a grease interceptor.
2. All interceptors shall be pre-cast concrete and have two (2) compartments, the smallest which shall have at least 1/3 the capacity of the entire interceptor.

#### C. Sizing

It is the responsibility of the generator and his/her contractors and consultants to ensure the wastewater discharge from their facility is in compliance with the City's discharge limitations. For the purpose of plan review, a general assessment of grease interceptor design will be performed using the following formulas:

##### Method 1: 2006 UPC Formula

Meals per Peak Hour (1)	Waste Flow Rate (2)	Retention Time (3)	Storage Factor (4)	Capacity (gal) (5)	Interceptor Size (gal)
<input type="text"/>	X <input type="text"/>	X <input type="text"/>	X <input type="text"/>	= <input type="text"/>	<input type="text"/>

### Step 1 – Meals per Peak Hour = Seating Capacity X Meal Factor

#### Meal Factors

Fast Food (45 min).....	1.33
Restaurant (60 min).....	1.00
Leisure Dining (90 min).....	0.67
Dinner Club (120 min).....	0.50

### Step 2 – Waste Flow Rate:

With Dishwasher.....	6 gallon flow
Without Dishwasher.....	5 gallon flow
Single Service Kitchen.....	2 gallon flow
Food Waste Disposer.....	1 gallon flow

### Step 3 – Retention Time

Commercial kitchen waste/dishwasher.....	2.5 hours
Single service kitchen.....	1.5 hours

### Step 4 – Storage Factor

Commercial kitchen – 8 hour operation.....	1
Commercial kitchen – 16 hour operation.....	2
Commercial kitchen – 24 hour operation.....	3
Single service kitchen.....	1.5

### Step 5 – Capacity

Multiply values from Steps 1-4. The result is the minimum approximate grease interceptor size for this application.

## Method 2: Drainage Fixture Unit Calculation

Where food is prepared, but as a general rule not consumed on the premises, or where seating capacity or number or meals served cannot adequately be determined, the following rule shall apply:

The following table establishes the drainage fixture unit values for various pieces of kitchen equipment, which may require connection to a grease interceptor. One drainage fixture unit shall equal 7.5 GPM. The total number of drainage fixture units shall be multiplied by 7.5 GPM to determine maximum rate of flow (GPM) possible into the grease interceptor. The volumetric capacity of the unit shall be five times the maximum rate of flow.

### Fixture Unit Values

Type of Fixture Value	Fixture Unit
Clothes Washer.....	3
Combination Sink and Tray with Food Waste Grinder.....	4
Combination Sink and Tray with one 1 ½ Inch Trap .....	2
Combination Sink and Tray with Separate 1 ½ Inch Traps.....	3

Pot or Scullery Sink.....	4
Prep Sink.....	2
Service Sink (Standard Trap).....	3
Service Sink (P Trap).....	2

All Other Fixtures:

1 ¼ Inch or less Trap Size.....	1
1 ½ Inch Trap Size.....	2
2 Inch Trap Size.....	3
2 ½ Inch Trap Size.....	4
3 Inch Trap Size.....	5
4 Inch Trap Size.....	6

Example: A total of twenty-one (21) fixture units are to be discharged to a grease interceptor.  $21 \text{ F.U.} \times 7.5\text{GPM} \times 5 \text{ minute retention} = 787.5 \text{ gallons.}$

### Method 3: for Schools (Public and Private)

The sizing of grease interceptors for school kitchens shall be as follows:

Number of students  $\times$  .6 (average daily participation)  $\times$  2.5 gallons per meal served equals volumetric capacity of grease interceptor. Example: 650 students  $\times$  .6 ADP = 390 meals. 390 meals  $\times$  2.5 gallons/meal = 975 gallons.

School wastewater pre-treatment units shall be in accordance with the City of Aurora Standards.

## D. Maintenance and Inspections

1. Periodic operations and maintenance inspections are performed by Aurora Water to ensure compliance with the Wastewater Control Ordinance, these Rules and Regulations, and Wastewater Discharge Permits. It shall be the responsibility of those engaged in the operation of a business (commercial or industrial) activity to maintain their associated wastewater pre-treatment facilities in efficient functioning order.
2. Grease Interceptors shall be pumped and cleaned of their accumulated matter quarterly or as often as necessary to ensure maximum efficiency and to prevent non-compliance with applicable discharge limitations.
3. A grease interceptor is deemed to require service when settled solids and FOG exceed twenty-five percent (25%) of the liquid capacity of either compartment of the tank.
4. Aurora Water may require a business to maintain a specific grease interceptor pumping and cleaning interval based on observed problems or non-compliance related to grease production, accumulation and wastewater discharges.
5. Grease interceptor pumping, cleaning and hauling service companies hired to perform work for food preparation establishments in the City of Aurora must be properly accredited and licensed according to Colorado state law.

6. Maintenance and pumping records must be kept onsite for a minimum of three (3) years. Aurora Water reserves the right to require a business to routinely submit maintenance and pumping records to the City.
7. Partial cleaning of grease interceptors is not allowed.
8. Biological, enzymatic, and chemical treatments of wastewater flows are not allowed.
9. Access to wastewater pre-treatment facilities shall remain unobstructed at all times. The removal of large objects such as boxes, crates, cans, etc. or the need for a ladder to inspect a wastewater pre-treatment facility shall constitute a violation of Wastewater Control Ordinance Section 138-292 (d)

## **E. Kitchen Best Management Practices (BMP)**

Kitchen BMPs benefit food preparation establishments by preventing grease discharges and keeping interceptor maintenance costs low.

### **1. BMPs for Food Preparation Establishments**

All food preparation establishments are required to follow kitchen Best Management Practices (BMP), including, but not limited to the following:

- A. Regularly train all employees on fats, oil and grease control and management.
- B. Prevent grease from entering drainage fixture units.
- C. Excess food waste and grease must be scraped off plates prior to washing.
- D. Food waste must be disposed of in the garbage.
- E. Drain screens must be installed on all drainage fixture units.
- F. Cooking grease (yellow grease) must be collected and recycled.

### **2. Additional BMPs for Kitchens with food waste grinders**

Drains associated with food waste grinders must be plumbed to the Grease Interceptor. A solids interceptor shall separate the discharge upstream of the grease interceptor where food waste grinders are installed.

## **IV. In-Line Grease Traps**

All grease traps shall be installed in accordance with the manufacturer's and City specifications.

### **A. Applicability**

In-line grease traps shall be allowed by the Aurora Water Department only where it is determined by the Department to be impractical to install a larger grease interceptor. Installation of in-line grease traps in lieu of grease interceptors requires written approval by the Aurora Water Department.

### **B. Sizing**

Grease traps shall have the grease retention capacity indicated below:

Total Flow Through Rating (gpm)	Grease Retention Capacity (pounds)
1-20	40
25	50
35	70
50	100

### **C. Materials and Structures**

1. Each in-line grease trap shall be constructed of durable materials satisfactory with the Aurora Water Department, and shall have a full gas-tight cover, which can be easily and readily removed.
2. Water-jacketed grease traps shall not be approved or installed.
3. Each in-line grease trap shall have an approved water seal of not less than two inches (2") in depth or the diameter of its outlet, whichever is greater.

### **D. Maintenance and Inspections**

1. Periodic operations and maintenance inspections shall be performed by Aurora Water to ensure compliance with the Wastewater Control Ordinance, these Rules and Regulations, and Wastewater Discharge Permits. It shall be the responsibility of those engaged in the operation of a business (commercial or industrial) activity to maintain their associated wastewater pre-treatment facilities in efficient functioning order.
2. In-line grease traps shall be cleaned of their accumulated matter as often as necessary to ensure maximum efficiency and to prevent non-compliance with applicable discharge limitations.
3. An in-line grease trap is shall require service when settled solids and FOG exceed twenty-five percent (25%) of the liquid capacity of the tank.
4. Aurora Water may require a business to maintain a specific in-line grease trap cleaning interval based on observed problems or non-compliance related to grease production, accumulation and wastewater discharges.
5. Maintenance records must be kept onsite for a minimum of three (3) years. Aurora Water reserves the right to require a business to routinely submit maintenance records to the City.
6. Grease trap cleaning and hauling service companies hired to perform work for food service establishments in the City of Aurora must be properly accredited and licensed according to Colorado state law.
7. Partial cleaning of in-line grease traps is not allowed.
8. Biological, enzymatic, chemical treatments of wastewater flows are not allowed.

9. Access to wastewater pre-treatment facilities shall remain unobstructed at all times. The removal of large objects such as boxes, crates, cans, etc. or the need for a ladder to inspect a wastewater pre-treatment facility shall constitute a violation of Wastewater Control Ordinance Section 138-292 (d).

## **V. Flow Equalization Units**

All flow equalizer units shall be installed in accordance with the standard drawings of the City of Aurora.

### **A. Applicability**

1. These rules and regulations shall apply to all types of car or truck washing facilities, and other users of the collection system capable of discharging large volumes of wastewater. Plans for these facilities and operation shall be submitted to the Aurora Water Department for approval of the type and size of the wastewater pre-treatment facility which may be required and to determine the need for a wastewater holding tank.

2. Businesses washing five (5) cars or less per day shall not be required to install wastewater holding tanks. They shall, however, be required to install an approved sand/oil interceptor.

### **B. Materials and Structures**

#### **1. Tank**

The need for a storage tank (holding tank) shall be based on actual or anticipated flows in the wastewater collection system at the point of connection and downstream so as to avoid sewer line surcharge. In the event such a tank is required, it shall have the following characteristics:

The storage tank shall have the capacity to hold one day's (24 hours) output of wastewater. It shall be the responsibility of the owner to ensure the adequacy of the storage tank.

#### **2. Bypass**

Under no circumstances shall by-pass connection be installed between the washing operation and the sanitary sewer.

#### **3. Pump**

A submersible sump pump with the capacity to drain the storage tank during a five (5) to six (6) hour period and, approved by the building division shall be installed. The maximum flow of the pump shall not exceed two hundred twenty-five (225) GPM.

The submersible pump shall be controlled by a timing device which shall allow the pump to operate during the period of 12:00 midnight to 6:00 a.m. Consequently, no more than 81,000 gallons of wastewater may be discharged during this six (6) hour period. Manual controls shall not be allowed and the control panel shall be locked at all times. The City reserves the right to place a lead seal on the timer box door.

#### **4. Timer and Seal**

Any time a seal must be broken in order to perform emergency repairs on the timer, and after the repairs have been completed, the seal shall be replaced by the Aurora Water Department.

It shall be unlawful to remove a seal on the timer control box in order to change the hour at which the pump is to operate. Penalties shall be in accordance with Section 138 of the City Code.

### **C. Maintenance and Inspections**

1. Periodic operations and maintenance inspections shall be performed by Aurora Water to ensure compliance with the Wastewater Control Ordinance, these Rules and Regulations, and Wastewater Discharge Permits. It shall be the responsibility of those engaged in the operation of a business (commercial or industrial) activity to maintain their associated wastewater pre-treatment facilities in efficient functioning order.

2. All flow equalization devices (holding tanks) and other wastewater pre-treatment facilities not specifically mentioned here must be inspected annually (1 year) by their respective owners. Maintenance and inspection records must be retained on site for a minimum of three (3) years.

3. Partial cleaning is not allowed.

4. Access to wastewater pre-treatment facilities shall remain unobstructed at all times. The removal of large objects such as boxes, crates, cans, etc. or the need for a ladder to inspect a wastewater pre-treatment facility shall constitute a violation of Wastewater Control Ordinance Section 138-292 (d).

## **VI. Acid Neutralization**

All acid neutralization tanks shall be installed in accordance with Detail #305, Appendix A; Standards and Specifications Regarding Water, Sanitary Sewer and Storm Drainage Infrastructure, latest revision.

### **A. Applicability**

Those individuals engaged in activities where acids are used, or stored shall be required to install and maintain acid neutralization wastewater pre-treatment units. Only those drains which may receive acids intentionally or accidentally shall be connected to the neutralization unit.

### **B. Materials and Structures**

Acid neutralization units shall be made of vitrified clay, high-density polyethylene, polypropylene or other material specified by a manufacturer for a specific application and approved by the General Manager of Aurora Water.

Concrete units lined with “acid resistant materials” shall not be approved.

#### **1. Neutralization Media**

Limestone chips or lumps are used in most acid wastewater pre-treatment units. These chips or lumps shall not be less than one inch (1") or greater than three inches (3") in any dimension.

## **2. Other Chemical Wastewater Pre-treatment Methods**

Other chemical wastewater pre-treatment methods exist and may be approved by the City of Aurora upon demonstration they are safe, conform to all applicable standards, and produce an effluent which is acceptable to the City of Aurora. These methods will be reviewed on a case-by-case basis and require written approval by Aurora Water prior to being installed or implemented.

### **C. Sizing**

Sizing of any acid neutralization unit shall be reviewed by Aurora Water and shall be as follows:

The number of sinks x 3.75 gallons per sink = Volumetric capacity of the unit (nearest size up).

In case a sink has more than one (1) compartment, each compartment shall be considered a separate sink.

The smallest acid neutralization tank allowed shall be a five (5) gallon capacity unit.

### **D. Maintenance and Inspections**

1. Periodic operations and maintenance inspections shall be performed by Aurora Water to ensure compliance with the Wastewater Control Ordinance, these Rules and Regulations, and Wastewater Discharge Permits. It shall be the responsibility of those engaged in the operation of a business (commercial or industrial) activity to maintain their associated wastewater pre-treatment facilities in efficient functioning order.

2. Acid Neutralization units shall be inspected by their owners at least quarterly (3 months) to ensure the neutralization media is at its prescribed level. Maintenance and inspection records must be retained on site for a minimum of three (3) years.

3. Partial cleaning is not allowed.

4. Access to wastewater pre-treatment facilities shall remain unobstructed at all times. The removal of large objects such as boxes, crates, cans, etc. or the need for a ladder to inspect a wastewater pre-treatment facility shall constitute a violation of Wastewater Control Ordinance Section 138-292 (d).



## **VII. Typical Sand and Oil Interceptors**

All interceptors shall be installed in accordance with Detail #304, Appendix A; Standards and Specifications Regarding Water, Sanitary Sewer and Storm Drainage Infrastructure, latest revision.

### **Applicability**

1. These Rules and Regulations shall apply to automotive/recreational service stations, truck or car wash facilities, vehicle maintenance facilities, mechanical repair shops, garden nurseries, warehouses, parking garages, machine shops, and other facilities where sand, oil, and/or hazardous wastes could enter the public sewer system.
2. Users with an elevator pit must either install a sand/oil interceptor or implement one of the other options outlined in Section IX of these Rules and Regulations.

### **A. Materials and Structures**

1. All sand and oil interceptors shall be two compartment, pre-cast concrete tanks. The smallest compartment shall have 1/3 the capacity of the entire interceptor.

### **B. Location**

All sand and oil interceptors shall be located outside, on private property, within thirty feet (30') and not less than five feet (5') from the facility served, unless otherwise approved by the General Manager of Aurora Water, and shall be accessible at all times for maintenance and inspection.

### **C. Sizing**

No combination sand and oil interceptor smaller than seven hundred fifty (750) gallon capacity shall be installed at a single bay facility.

The sizing shall be reviewed by the Aurora Water Department and shall be as follows: Three inch (3") diameter flow drains are rated at six (6) drainage fixture units (DFU) Four inch (4") diameter flow drains are rated at eight (8) DFU

Sizing formula shall be as follows:

$$\text{DFU connected} \times 7.5 \text{ GPM} \times 5 \text{ minutes} = \text{Interceptor Size.}$$

#### **1. Trough Drains**

Where trough drains are used, each bay, or compartment, or area equaling the square foot surface of a standard service station bay which is served by a trough drain shall be rated at six (6) DFU per bay.

#### **2. Vehicle Wash Drains**

Vehicle wash drains will be rated at eight (8) DFU each regardless of size.

#### **D. Maintenance and Inspections**

1. Periodic operations and maintenance inspections shall be performed by Aurora Water to ensure compliance with the Wastewater Control Ordinance, these Rules and Regulations, and Wastewater Discharge Permits. It shall be the responsibility of those engaged in the operation of a business (commercial or industrial) activity to maintain their associated wastewater pre-treatment facilities in efficient functioning order.
2. Sand/oil interceptors shall be pumped and cleaned of their accumulated matter as often as necessary to ensure maximum efficiency and to prevent non-compliance with applicable discharge limitations.
3. A sand/oil interceptor is shall require service when settled solids and floating oil exceed twenty-five percent (25%) of the liquid capacity of either compartment of the tank
4. Aurora Water may require a business to maintain a specific sand/oil interceptor pumping and cleaning interval based on observed problems or non-compliance related to sand/oil production, accumulation and wastewater discharges.
5. Interceptor pumping, cleaning and hauling service companies hired to perform work for businesses in the City of Aurora must be properly accredited and licensed according to Colorado state law.
6. Maintenance and pumping records must be kept onsite for a minimum of three (3) years. Aurora Water reserves the right to require a business to routinely submit maintenance and pumping records to the City.
7. Partial cleaning of sand/oil interceptors is not allowed.
8. Biological, enzymatic, chemical treatments of wastewater flows are not.
9. Access to wastewater pre-treatment devices shall remain unobstructed at all times. The removal of large objects such as boxes, crates, cans, etc. or the need for a ladder to inspect a wastewater pre-treatment facility shall constitute a violation of Wastewater Control Ordinance Section 138-292 (d)

#### **VIII. Trailer Courts and Mobile Home Parks**

1. All lot sanitary sewer drain inlets shall be extended not more than four inches (4") above ground. Mobile home lot drain inlets and extensions to grade shall be of material approved for underground use within a building.
2. All material used for sewer connections between a mobile home and the sanitary sewer inlet shall be rigid, corrosion resistant, non-absorbent, and durable. The inner surface shall be smooth.
3. Provisions shall be made for plugging or capping the lot sanitary sewer inlet when a mobile home does not occupy the lot.
4. Connections from the sanitary sewer drain outlet to the sanitary sewer lot drain inlet

shall be water and airtight. When a mobile home lot is vacant, the drain on the lot shall be capped, so as to be water and airtight.

## **IX. Elevator Pits**

New users with elevator pits shall not have drains in those elevator pits connected directly to the sanitary sewer. Sump pumps may be installed in elevator pits. The requirement for a sump pump to be installed is to be determined by the building engineer, architect, or equivalent and/or as required by the local building authority.

In the event it is determined a sump pump shall be installed, there are three (3) options to manage the discharge of accumulated wastewater from the sump:

1. If a sand/oil interceptor is already required in the facility (e.g., a parking garage, maintenance garage, or warehouse where floor drains are present), then the sump pump outlet may be plumbed through the sand/oil interceptor. A sand/oil interceptor may not be installed for the sole purpose of draining the elevator pit, because not enough wastewater will pass through the sand/oil interceptor to allow it to function as designed.
2. If a sump pump is to be plumbed to the sanitary sewer and a sand/oil interceptor is not required based on other infrastructure, an oil detector shall be installed which will shut-off the flow of wastewater and sound an alarm in the event oil is detected in the wastewater. In the event the oil detector shuts off wastewater flow and the alarm sounds, the wastewater in the elevator pit shall be handled as discussed below.
3. If the sump pump is not to be plumbed directly to the sanitary sewer, it may be plumbed to a holding reservoir. The size and structure of the holding reservoir is to be determined by the building engineer, architect, or equivalent and/or as required by the local building authority. Wastewater in the holding reservoir shall be handled as discussed below.
4. Wastewater may be continuously discharged to the sanitary sewer via a sump pump if the required oil detector described above is installed and maintained in working order. Below are approved options for handling wastewater in elevator pits where the oil detector alarm has been activated, wastewater accumulated at the bottom of a sump where there is no pump and no discharge, or wastewater in a holding reservoir:
5. If the wastewater is to be discharged to the sanitary sewer, oil on the top of the water must be skimmed off or absorbed using oil absorbent pads or equivalent and disposed of by an appropriate waste hauler. Following removal of the oil, if the wastewater is in an elevator pit, the remaining wastewater may be discharged to the sanitary sewer via the sump pump. If the wastewater is in a holding reservoir or at the bottom of a sump where there is no pump and no discharge, the wastewater may then be discharged to the sanitary sewer via appropriate means (i.e. hose, bucket transport, etc.).
6. Wastewater in either the elevator pit or holding reservoir may be containerized and hauled off-site by an appropriate waste hauler.

7. If the volume of wastewater accumulating in the bottom of a sump where there is no pump and no discharge or in a holding reservoir is limited and does not require discharge to the sanitary sewer or off-site disposal, the wastewater may be allowed to evaporate.

## **X. Venting**

Where the venting of an interceptor is connected to building vent piping, the authority of the Aurora Water Department will stop just prior to this connection and vent piping shall be constructed per Aurora Building Division requirements

### **A. Vents not required**

Where permitted by the Aurora Water Department, vent piping may be omitted on an interceptor when such interceptor acts as a primary settling tank and discharges through a horizontal indirect waste pipe into a secondary interceptor. The second interceptor shall be properly trapped and vented.

### **B. Materials**

1. Vent pipe shall be cast iron, galvanized steel, galvanized wrought iron, lead, copper or brass. Where combustible construction is allowed, ABS and PVC vent pipe will be approved.
2. No galvanized wrought iron or galvanized steel pipe shall be used underground, but shall be kept at least six inches (6") above the ground.
3. Vent fittings shall be cast iron, galvanized steel, galvanized malleable iron, lead, copper, brass, ABS, PVC, except no galvanized iron or galvanized steel fitting shall be used underground but shall be kept at least six inches (6") above the ground.
4. Changes in direction of vent piping shall be made by the appropriate use of approved fittings and no such pipe shall be strained or bent. Burred ends shall be reamed to the full bore of the pipe.

### **C. Size of Vents**

The size of vent piping shall be determined from its length and the total number of fixture units connected thereto, as set forth below.

A vent may exceed 1/3 of the maximum horizontal length as limited by Table 3 only if the vent is increased one (1) pipe size for its entire length.

### **D. Vent Pipe Grades and Connections**

1. All vent and branch vent pipes shall be free from drops or sags and each such vent shall be level or shall be so graded and connected as to drip back by gravity to the drain pipe it serves.
2. Where vents connect to a horizontal drainpipe, each vent pipe shall be taken off the centerline of such pipe ahead of the trap being served.

3. Unless prohibited by structural conditions, each vent shall rise vertically to a point not less than six inches (6") above the flood level rim of the fixture served before offsetting horizontally, and whenever two (2) or more vent pipes converge, each such vent pipe shall rise to a point at least six inches (6") in height above the flood level rim of the plumbing fixture its served before being connected to any other vent. When horizontal vents are less than six inches (6") above flood level rim of the fixture, the horizontal portion shall be installed with approved drainage material.

4. All vent pipes shall extend undiminished in size above the roof, or shall be reconnected with a soil or waste vent of proper size. Weather heads will not be allowed.

### **E. Vent Termination**

1. Each vent pipe or stack shall extend through its flashing and shall terminate vertically not less than ten inches (10") above the roof nor less than one foot (1') from any vertical surface.

2. Each vent shall terminate not less than ten feet (10') from or at least three feet (3') above any window, door, opening, air intake, or vent shaft, nor less than three feet (3') in any direction from any lot line; alley and street.

3. Vent pipes shall be extended separately or combined of full required size, not less than ten inches (10") above the roof or firewall.

4. Vent pipes for outdoor installations shall extend at least ten feet (10') above the surrounding ground and shall be securely supported.

5. Joints around vent pipes shall be made watertight by the use of approved flashing or flashing material.

### **Venting for Grease and Combination Sand and Oil Interceptors**

<b>Pipe Size</b>	<b>Max. Drainage Fixture Units</b>	<b>Max. Lengths</b>
1 ½"	1	45
1 ½"	8 (1)	60
2" (Min exterior vent size)	24	120
2 ½"	48	160
3" (2)	84	212
4"	256	300
5"	600	390
6"	1380	510

Note: (1) Except six (6) unit traps

(2) Minimum pipe diameter of inlet and outlet of Type A, B, and C grease interceptors, Type A and B combination Sand and Oil Interceptors.

Note: The diameter of an individual vent shall not be less than one and one fourth inches (1¼") nor less than one-half of the diameter of the drain to which it is connected.

## **XI. Swimming Pools**

These Rules and Regulations shall apply to discharges from swimming pools and all those private individuals, commercial and industrial firms. Swimming pool discharges are not allowed to enter the public sanitary sewer system unless approved by the General Manager of Aurora Water per Wastewater Control Ordinance Section 138-263 (c).

Any persons discharging swimming pool water to the storm or sanitary sewer system must first notify the Aurora Water Department by calling 303-326-8645.

Discharges of swimming pool water from pools other than residential pools may be subject to discharge permitting requirements of the state of Colorado. More information may be obtained from Water Quality Control Division of the Colorado Department of Public Health and the Environment (CDPHE) 303-692-2000.

Aurora Water accepts no responsibility for damage resulting from the discharging of any swimming pool water. Any variation from this procedure will be considered a direct violation of Chapter 138 of Aurora Municipal Code and will be grounds for issuance of a Notice of Violation or Summons and Complaint by Aurora Water.

### **A. Discharge to the Sanitary Sewer**

1. Discharges of swimming pool water to the sanitary sewer system may require pre-authorization from the Metro Wastewater Reclamation District 303-286-3000.
2. Backwash filter wastewater discharge shall be connected only to the sanitary sewer.
3. Wastewater pre-treatment prior to discharge may be required.
4. Draining pools to the sanitary sewer shall be accomplished only between the hours of 12:00 midnight and 6:00 a.m., or at a time established by the General Manager of Aurora Water.
5. The drain from the pool shall be permanently controlled to discharge no more than 0.5 cubic feet per second or two hundred twenty-five (225) gpm.

### **B. Discharge to the Storm Sewer**

1. Swimming pool discharges shall not have a physical connection to the storm drain system.
2. All discharges of swimming pool water to the storm drain system must be de-chlorinated and filtered.
3. No swimming pool water shall be discharged where it will empty into a public right of way at a rate exceeding two hundred twenty-five (225) gpm, or at any rate which endangers property of other owners.
4. No pool wastewater shall be discharged into the public right of way during freezing weather.

5. Pool water may be discharge to a vegetated area of the owner's property as long as neighboring properties are not adversely impacted, the discharge is diverted away from building foundations, and it does not cause erosion or nuisance conditions.

## **XII. Metro Wastewater Reclamation District Discharge Limitations – Excerpt from Section 6, Rules and regulations Governing the Operation, Use and Services of the System**

### **6.13 General Requirements Regarding Deleterious Wastes**

None of the following described sewage, water, substances, materials or waste shall be discharged into the Metro District's (District) system or the sewer system of any municipality by any Industrial User. These requirements and prohibitions may be imposed directly on process wastewaters prior to dilution by domestic and other wastewaters discharged by the Industrial Users. Site-specific limitations and/or Best Management Practices (BMPs) may be developed and imposed on Industrial Users to ensure compliance with these *Rules and Regulations*.

1. Sewage of such a nature and delivered at such a rate as to impair the hydraulic capacity of the system, normal and reasonable wear and usage expected.
2. Sewage of such a quantity, quality, or other nature as to impair the strength or the durability of the sewer structures, equipment or treatment works, either by chemical or by mechanical action.
3. Sewage having a flash point lower than one hundred eighty-seven degrees (187°F), as determined by the test methods specified in 40 CFR §261.21.
4. Any radioactive substance, the discharge of which, does not comply with Section RH 4.35 of the Colorado *Rules and Regulations pertaining to Radiation Control* (Volume 6 of the Code of Colorado Regulations, 6 CCR 1007-1, Part 4, et seq.).
5. Any garbage other than that received directly into the sewer system of a municipality from domestic and commercial garbage grinders in dwellings, restaurants, hotels, stores, and institutions, by which such garbage has been shredded to such a degree so all particles will be carried freely under flow conditions normally prevailing in public sewers with no particle greater than one half inch (½") in any dimension.
6. Any night soil or septic tank pumpage, except by permit in writing from the Metro District at such points and under such conditions as the District may stipulate in each permit.
7. Sludge or other material from sewage or industrial waste treatment plants or from water treatment plants, except such sludge or other material, the discharge of which to the system shall be governed by the provisions of this agreement herein set forth or as otherwise authorized by the Metro District.
8. Water which has been used for cooling or heat transfer purposes without

recirculation, discharged from any system of condensation, air conditioning, refrigeration, or similar use.

9. Water accumulated in excavations or accumulated as the result of grading, water taken from the ground by well points, or any other drainage associated with construction.

10. Any water or wastes containing grease or oil and other substances which will solidify or become discernibly viscous at temperatures between thirty-two degrees (32°F) and one hundred fifty degrees (150°F) except by permit in writing from the Metro District at such points and under such conditions as the District may stipulate in each permit.

11. Any wastes containing a corrosive, noxious, or malodorous material or substance which, either singly or by reaction with other wastes, is capable of causing damage to the System or to any part thereof, of creating a public nuisance, or a hazard, or of preventing entry into the sewers for maintenance and repair.

12. Any wastes containing concentrated dye wastes or other wastes which are either highly colored or could become highly colored by reacting with any other wastes, except by permission of the Metro District.

13. Any wastes which are unusual in composition; i.e., contain an extremely large amount of suspended solids or BOD; are high in dissolved solids such as sodium chloride, calcium chloride, or sodium sulfate; contain substances conducive to creating tastes or odors in drinking water supplies; otherwise make such waters unpalatable even after conventional water purification treatment; or are in any other way extremely unusual unless the Metro District determines such wastes may be admitted to the system or shall be modified or treated before being so admitted.

14. Any substance which may cause the Metro District's effluent or any other product of the District such as residues, sludges or scums, to be unsuitable for reclamation and reuse or to interfere with the reclamation process. In no case, shall a substance discharged to the system cause the District to be in non-compliance with sludge use or disposal criteria, guidelines or regulations developed under Section 405 of the Federal Water Pollution Control Act; any criteria, guidelines, or regulations affecting sludge use or disposal developed pursuant to the Solid Waste Disposal Act, the Clean Air Act, the Toxic Substances Control Act, or State criteria applicable to the sludge management method being used.

15. Any substance which may cause the District to violate its National Pollutant Discharge Elimination System (NPDES) Permit or the receiving water quality standards.

16. Except for existing combined sewer facilities, any stormwater, directly or indirectly, from surface drains, ditches, or streams, storm or combined sewers, roof, areaway, sumps and sump pumps, or foundation drains, or from any other means, including subsurface drainage or groundwater.



17. Any water or wastes potentially contaminated with (1) transmissible spongiform encephalopathy agents from diseases such as chronic wasting disease, bovine spongiform encephalopathy, scrapie, Creutzfeldt-Jakob disease, (2) foot-and-mouth disease agents, or (3) anthrax, except by permission of the Metro District.

#### **6.14 Prohibited Discharges**

None of the following described sewage, water, substances, materials, or wastes shall be discharged into the Metro District's system or into the sewer system of any municipality, by any Industrial User. These requirements and prohibitions may be imposed directly on process wastewaters prior to dilution by domestic and other wastewaters discharged by the Industrial Users. Site-specific limitations and/or Best Management Practices may be developed and imposed on Industrial Users to ensure compliance with these *Rules and Regulations*.

1. Any liquids, solids or gases which by reason of their nature or quantity are, or may be, sufficient either alone or by interaction with other substances to cause fire or explosion or be injurious in any other way to the Metro District's system, the sewer system of a municipality or any of its connectors, or to the operation of the District. At no time shall any reading on an explosion hazard meter, at the point of discharge into the District's system or the sewer system of a municipality or any of its connectors (or at any point in the systems), or at any monitoring location designated by the District in a Wastewater Discharge Permit, be more than ten percent (10%) of the Lower Explosive Limit (LEL) of the meter. Prohibited materials include, but are not limited to, gasoline, kerosene, naphtha, benzene, toluene, xylene, ethers, alcohols, ketones, aldehydes, peroxides, chlorates, perchlorates, bromates, carbides, hydrides, and sulfides

2. Any solid or viscous material which could cause an obstruction to flow in the sewers or in any way could interfere with the treatment process, including as examples of such materials but without limiting the generality of the foregoing, significant proportions of ashes, wax, paraffin, cinders, sand, mud, straw, shavings, metal, glass, rags, lint, feathers, tars, plastics, wood and sawdust, paunch manure, hair and fleshings, entrails, lime slurries, beer and distillery slops, grain processing wastes, grinding compounds, acetylene generation sludge, chemical residues, acid residues, food processing bulk solids, snow, ice, and all other solid objects, material, refuse, and debris not normally contained in sanitary sewage.

3. Any wastewater having a pH less than 5.0 for discharges from Industrial Users into the Metro District's system or the sewer system of a municipality or that of any of its connectors, or less than 6.0 or greater than 9.0 for other discharges into the District's system, or wastewater having any other corrosive property capable of causing damage or hazard to any part of the District's system or the sewer system of a municipality or any of its connectors, or to personnel.

4. Any wastewater having a temperature which will inhibit biological activity at the District's treatment plant, but in no case wastewater containing heat in such amounts the temperature at the introduction into the District's treatment plant exceeds forty degrees (40°)C (one hundred four degrees (104°)F).

5. Any pollutants, including oxygen demanding pollutants (BOD, etc.) released at a flow rate and/or pollutant concentration which cause pass through or interference. In no case shall a slug load have a flow rate or contain concentrations or qualities of pollutants that exceed for any time period longer than fifteen (15) minutes more than five (5) times the average twenty-four (24) hour concentration, quantities, or flow during normal operation.
6. Any water or wastes containing a toxic substance in sufficient quantity, either singly or by interaction with other substances, to injure or interfere with any sewage treatment process, to constitute a hazard to humans or to animals, or to create any hazard or toxic effect in the waters which receive the treated or untreated sewage.
7. Petroleum oil, non-biodegradable cutting oil, or products of mineral oil origin, each in amounts that will cause Interference or pass through.
8. Pollutants which result in the presence of toxic gases, vapors, or fumes within the system in a quantity that may cause acute worker health and safety problems.
9. Any trucked or hauled pollutants except at discharge points designated by the Metro District.
10. Any water or wastes containing pollutant quantities or concentrations exceeding the limitations in Section 6.18 of these *Rules and Regulations* or the limitations in any applicable Categorical Standards.
11. Any wastewater discharges to the Metro District's system, except at locations approved by the Metro District.
12. Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters (including, but not limited to, materials which have been removed by catch basins, grease traps, sand traps or pre-treatment systems/devices), or acquired from another person or location.
13. Wastewater which alone or in conjunction with other sources causes the Metro District's effluent to fail toxicity testing.
14. Detergents, surface-active agents or other substances which alone or in conjunction with other sources cause excessive foaming in the collection system or at the treatment plant.

#### **6.15 Specific Discharge Limitations - Municipalities**

No Municipality shall discharge to the system at any time or over any period of time wastewater containing any of the following materials and substances in excess of the limitations provided herein:

##### Limit mg/L

1. Cyanides (as HCN) 2
2. Oil and Grease (Hexane or approved solvent extractable) 75
3. Phenolic compounds (as Phenol) 10

#### 4. Sulfides (as H<sub>2</sub>S) 10

### 6.16 Reserved

### 6.17 General Discharge Prohibitions

No Industrial User shall contribute or cause to be contributed, directly or indirectly, any pollutant or wastewater which will pass through or Interfere with the operation or performance of the Metro District. These general prohibitions apply to all Industrial Users of the system whether or not the Industrial User is subject to National Categorical Pre-treatment Standards or any other national, state, district, or local Pre-treatment Standards or Requirements: Industrial Users may not discharge any of the sewage, water, substances, materials, or wastes listed in Sections 6.13 or 6.14 of these *Rules and Regulations*. These requirements and prohibitions may be imposed directly on process wastewaters prior to dilution by domestic and other wastewaters discharged by the Industrial Users. Site-specific limitations and/or Best Management Practices may be developed and imposed on Industrial Users to ensure compliance with these *Rules and Regulations*.

### 6.18 Specific Discharge Limitations - USERS

**6.18.1 Metro District Limitations.** No Industrial User shall discharge into the system or into any sewer system at any time or over any period of time, wastewater containing any of the following materials and substances in excess of the limitations provided herein. These limitations may also be imposed directly on process wastewaters prior to dilution by domestic and other wastewaters discharged by the Industrial User:

#### Limit mg/L

1. Arsenic 0.33
2. Cadmium 3.4
3. Chromium 3.6
4. Copper 6.1
5. Lead 2.2
6. Mercury 0.13
7. Molybdenum 0.43\*
8. Nickel 5.6
9. Selenium 0.66
10. Silver 2.9
11. Tetrachloroethene 1.5\*\*
12. Zinc 15.6

\* Notwithstanding this numeric limitation, effective January 1, 2007, discharge from cooling towers, boilers, closed-loop heat transfer systems and any other cooling/heating system treated with molybdenum-containing water treatment chemicals is prohibited entirely. Where necessary, the Metro District may require that these wastes be physically prevented from discharging into the sanitary sewer system.

**\*\* Notwithstanding this numeric limitation, the discharge of dry-cleaning process wastes, including new and used tetrachloroethene (perchloroethylene), still bottom oil, and separator water, is prohibited entirely. Where necessary, the Metro District may require that these wastes be physically prevented from discharging into the sanitary sewer system.**

**6.18.2 National Pre-treatment Standards and Requirements.** Once promulgated, Categorical Standards for a particular industrial subcategory, if more stringent, shall supersede all conflicting discharge limitations contained in this Section 6, as they apply to that industrial subcategory. All Industrial Users must comply with all applicable National Pre-treatment Standards and Requirements.

**6.18.3 State Requirements.** State requirements and limitations on discharges shall apply in any case where they are more stringent than federal requirements and limitations or those contained elsewhere in this Section 6.

**6.18.4 Dilution Prohibited.** Except where permitted by Categorical Standards, no Industrial User may increase the use of process water or, in any way, attempt to dilute a discharge as a partial or complete substitute for adequate treatment to attain compliance with the limitations contained in National Categorical Pre-treatment Standards or any other specific discharge limitations contained in this Section 6. The Metro District may set or require a municipality to set mass limitations or alternate concentration-based limitations for those Industrial Users which are using improper dilution to meet these limitations.

## **XIII City of Aurora Code Discharge Limitations – Excerpt from Section 138-263 Use of Public Sewers**

Sec. 138-263. Use of public sewers.

(a) *Rules and regulations.* It shall be the responsibility of the General Manager of Aurora Water to formulate rules and regulations governing the discharge of wastewater to the POTW consistent with this article.

(b) *Discharge of drainage and unpolluted waters.* It shall be unlawful for any person to discharge or cause to be discharged, any stormwater, surface water, groundwater, roof runoff, subsurface drainage, uncontaminated cooling water or unpolluted industrial process waters into any sanitary sewer. Stormwater and all other unpolluted drainage shall be discharged to such drains which are specifically designated as storm drains or to a natural outlet approved by the General Manager of Aurora Water. Industrial cooling water or unpolluted process waters may be discharged, on approval of the General Manager of Aurora Water, to a storm sewer or natural outlet.

(c) *Swimming pools.* Persons operating swimming pools which are connected directly or indirectly to the public sewer system shall drain those pools only in accordance with the drainage schedule established by the General Manager of Aurora Water. Such persons shall also notify the General Manager of Aurora Water at least twenty-four (24) hours

before draining their pools.

(d) *General discharge prohibitions.*

(1) No person shall contribute or cause to be contributed, directly or indirectly, any pollutant or wastewater which interferes with the operation or performance of the POTW.

(2) No person shall contribute the following substances to the POTW:

a. Any liquids, solids or gases which by reason of their nature or quantity are or may be sufficient, either alone or by interaction with other substances, to cause fire or explosion or be injurious in any other way to the POTW or to the operation of the POTW. Prohibited materials include but are not limited to gasoline, kerosene, naphtha, benzene, toluene, xylene, ethers, alcohols, ketones, aldehydes, peroxides, chlorates, perchlorates, bromates, carbides, hydrides and sulfides.

b. Solid or viscous substances which may cause obstruction to the flow in a sewer or other interference with the operation of the wastewater treatment facilities, such as but not limited to grease, garbage with particles greater than one half inch ( $\frac{1}{2}$ " ) in any dimension, animal entrails or tissues, paunch manure, bones, hair, hides or fleshings, whole blood, feathers, ashes, cinders, sand, spent lime, stone or marble dust, metal, glass, straw, shavings, grass clippings, rags, spent grains, spent hops, wastepaper, wood, plastics, tar, asphalt residues from refining or processing of fuel or lubricating oil, mud or glass grinding or polishing wastes.

c. Any wastewater containing toxic pollutants, hazardous wastes as defined by the Resource Conservation and Recovery Act, whether or not they are considered to be hazardous after entering the POTW, or poisonous substances in sufficient quantity, either singly or by interaction with other pollutants, to injure or interfere with any wastewater treatment process, constitute a hazard to humans or animals, create a toxic effect in the receiving waters of the POTW, or exceed the limitation set forth in a categorical standard.

d. Sewage of such a nature and delivered at such a rate as to impair the hydraulic capacity of the system, or any part thereof; normal and reasonable wear and usage excepted.

e. Sewage of such a quantity, quality, or other nature as to impair the strength or the durability of the sewer structures, equipment or treatment works, either by chemical or by mechanical action.

f. Any night soil or septic tank pumpage, except by permit in writing from the General Manager of Aurora Water at such points and under such conditions as the General Manager of Aurora Water may stipulate in each permit.

g. Sludge or other material from sewage or industrial waste treatment plants or from water treatment plants, except when authorized by the General Manager of Aurora Water.

- h. Water which has been used for cooling or heat transfer purposes without recirculation, discharged from any system of condensation, air conditioning, refrigeration, or similar use.
- i. Water accumulated in excavations or accumulated as the result of grading, water taken from the ground by well points, or any other drainage associated with construction.
- j. Any water or wastes containing grease or oil or other substances that will solidify or become discernibly viscous within a temperature range set forth in the rules and regulations promulgated by the General Manager of Aurora Water.
- k. Any wastes that contain a corrosive, noxious, or malodorous material or substance which, either singly or by reaction with other wastes, are capable of causing damage to the system or to any part thereof, of creating a public nuisance or hazard, or of preventing entry into the sewers for maintenance and repair.
- l. Any wastes which are unusual in composition, i.e., contain an extremely large amount of suspended solids or BOD; are high in dissolved solids such as sodium chloride, calcium chloride, or sodium sulfate; contain substances conducive to creating tastes or odors in drinking water supplies; otherwise make such waters unpalatable even after conventional water purification treatment; or are in any other way extremely unusual unless the General Manager of Aurora Water determines that such wastes may be admitted to the system or shall be modified or treated before being so admitted.
- m. Any wastes that contain excessive, as determined by the General Manager of Aurora Water, dye waste or others that are either highly colored or could become highly colored by reacting with any other wastes.
- n. Any substance which may cause the POTW's effluent or any other product of the POTW, such as residues, sludges or scums to be unsuitable for reclamation and reuse or to interfere with the reclamation processes. In no case shall a substance discharged to the POTW cause the POTW to be in noncompliance with sludge use or disposal criteria, guidelines or regulations developed pursuant to the Solid Waste Disposal Act, the Resource Conservation and Recovery Act, the Clean Air Act, the Toxic Substances Control Act, the Marine Protection, Research and Sanctuary Act, or more stringent state or local criteria, guidelines, or regulations applicable to the sludge management method being used.
- o. Any substance which will cause the POTW to violate its NPDES permit or the receiving water quality standards.
- p. Any wastewater having a temperature which will inhibit biological activity in the POTW treatment plant resulting in interference, but in no case wastewater containing heat or capable of creating heat in such amounts that the temperature at the introduction into the POTW treatment plant exceeds forty degrees (40°) Celsius (one hundred four degrees (104°) Fahrenheit).

q. Any pollutants, including oxygen demanding pollutants (BOD), etc., released at a flow rate and/or pollutant concentration which will cause pass through or interference. In no case shall a slug discharge have a flow rate or contain concentrations or qualities of pollutants that exceed for any time period longer than fifteen (15) minutes more than five (5) times the average twenty-four (24) hour concentration, quantities, or flow during normal operation.

r. Any wastewater containing any radioactive wastes or isotopes of such half-life or concentration as may exceed limits established by the General Manager of Aurora Water in compliance with applicable metro district, state or federal regulations.

(3) The prohibitions in subsection (d)(2) of this section shall apply to all users of the POTW whether or not the user is subject to national categorical pre-treatment standards or any other national, state, or local pre-treatment standards or requirements.

(4) When the General Manager of Aurora Water determines that a user is contributing any of the enumerated substances in subsection (d)(2) of this section or others not enumerated to the POTW in such amounts as to interfere with the operation of the POTW, the General Manager of Aurora Water shall:

a. Advise the user of the impact of the contribution on the POTW; and

b. Develop effluent limitations for such user to correct the interference with the POTW.

(5) If any user violates this subsection, nothing in this subsection shall limit the authority of the General Manager of Aurora Water to seek enforcement of this subsection against the user pursuant to Section 138-293.

(e) *National categorical pre-treatment standards.* Upon the promulgation of a national categorical pre-treatment standard for a particular industrial subcategory, if more stringent limitations than those imposed under this article for sources in particular subcategory are promulgated, the national standard shall immediately supersede the limitations imposed under this article. The General Manager of Aurora Water shall notify all affected users of the applicable reporting requirements under 40 CFR 403.12.

(f) *Specific pollutant discharge standards.* Specific pollutant discharge standards are to be set forth by the General Manager of Aurora Water in the rules and regulations governing pollutant discharge and wastewater control.

(g) *State requirements.* State requirements and limitations on discharges shall apply in any case where they are more stringent than federal requirements and limitations or those in this article.

(h) *City's right of revision.* The City reserves the right to establish more stringent limitations or requirements on discharges to the POTW if deemed necessary to comply with the objectives presented in Section 138-258.

(i) *Excessive discharge.* No user shall ever increase the use of process water or, in any way, attempt to dilute a discharge as a partial or complete substitute for adequate treatment to achieve compliance with the limitations contained in the national categorical pre-treatment standards, or in any other pollutant specific limitation developed by the City or state.

(j) *Accidental discharges.* Each user shall provide protection from accidental discharge of prohibited materials or other substances regulated by this article. Facilities to prevent accidental discharge of prohibited materials shall be provided and maintained at the owner's or user's own cost and expense. Detailed plans showing facilities and operating procedures to provide this protection shall be submitted to the city for review and shall be approved by the city before construction of the facility. All existing users shall complete such a plan by July 1, 1983. No user who commences contribution to the POTW after the effective date of this division shall be permitted to introduce pollutants into the system until accidental discharge procedures have been approved by the City. Review and approval of such plans and operating procedures shall not relieve any user from the responsibility to modify the user's facility as necessary to meet the requirements of this article. In the case of any accidental or unusual discharge, the user shall immediately telephone and notify the City and the Metro District of the incident. The notification shall include the location, type, concentration, and volume of discharge, and corrective actions.

(k) *Written notice.* Within five (5) days following an accidental discharge, the user shall submit to the General Manager of Aurora Water a detailed written report describing the cause of the discharge and the measures to be taken by the user to prevent similar future occurrences. Such notification shall not relieve the user of any expense, loss, damage, or other liability which may be incurred as a result of damage to the POTW, fish kills, or any other damage to person or property nor shall such notification relieve the user of any fines, civil penalties, or other liability which may be imposed by this article or other applicable law.

(l) *Notice to employees.* A notice shall be permanently posted on the user's bulletin board or other prominent place advising employees whom to call if an accidental discharge occurs. Employers shall ensure that all employees, who may cause or suffer such an accidental discharge to occur, are advised of the emergency notification procedure.

(Code 1979, § 39-104; Ord. No. 2005-74, § 1, 10-10-2005)



## Appendix D



### Irrigation Standards

## I. Irrigation Design Standards

(a) *Purpose.* To conserve water resources and promote the efficient use of water resources by establishing requirements for design, installation and maintenance of automatic irrigation systems.

(b) *Applicability.* These standards shall apply to:

(1) New development. All new development where automatic underground irrigation of landscape areas is required per Chapter 146, Article 14 (Landscaping), including all common area landscape tracts, tree lawns, private common open space and private parks.

a. Individual residential lots. The individual lots of single-family detached homes, two-family homes, and single-family attached duplex homes shall be required to comply only with equipment requirements and the final construction observation requirements of this section.

(2) Replacement of existing irrigation systems. Existing irrigation systems being replaced, modified, upgraded or expanded pursuant to Chapter 146. Existing irrigation systems that are operating in an efficient manner and are not found to be wasting water as found in Section 138-190 of the City of Aurora Code are exempt from these standards when performing routine maintenance, and repairs.

(c) *Irrigation design plan.* Prior to the installation of the irrigation system the Aurora Water Department shall approve a design plan prepared by a designer that complies with the system requirements specified in this section. An electronic AutoCAD file with .dwg file extension or .pdf is preferable.

The irrigation design plan shall accurately and clearly identify:

- Property boundaries.
- Locations, model and size of all components of the irrigation system.
- Detailed drawings of all major components of the irrigation system.
- Static water pressure at the point of connection.
- Flow rate, zone number, application rate (inches per hour), and design operating pressure for each zone or station on the controller.
- Backflow preventer.
- The square footage of turf and planting beds on the plans.
- Pressure loss worksheet.
- Calculation of water usage in gallons for the year.
- Irrigation schedule.
- Clearly displayed registered Landscape Architect or Certified Irrigation Designer (CID) Stamp.
- Note stating **“An Irrigation and Soil Permit is required. Please call Water Conservation at 720-8594364 to obtain your permit”.**

(d) *System requirements.*

(1) Flow requirement. The system shall be designed so it is capable of providing sufficient water for adequate plant growth during periods of peak demand when evapotranspiration (ET) is highest. Peak demand shall be based on 1.8 inches per week for turf and 1.0 inch per week for planting beds. Water requirements for each site must be determined prior to designing the system in order to size the system for adequate capacity.

(2) Pressure control. In order to control pressure and protect the system from damage, pressure-reducing valves shall be located immediately downstream of the backflow preventer if static pressure is fifteen (15) Pounds per Square Inch (PSI) above the system design pressure. System design pressure is the required operating pressure at the head plus total system pressure losses, including tap, service and meter. Pressure at all heads shall be within ten percent (10%) of the system design operating pressure. (Example: a head designed for 30.0 PSI shall operate within the 27.0 to 33.0 PSI range.) A combination pressure-reducing and control valve can be used to control the pressure within a zone.

(3) Master valves shall be installed on all non-residential irrigation systems.

(4) Sprinkler head layout. Head spacing shall not exceed fifty percent (50%) of the diameter of each head's effective coverage. Part circle heads must be used around the entire turf/bed perimeter to avoid overthrow onto buildings, asphalt, concrete, etc., and walks. Radius reduction at the head shall not exceed twenty-five percent (25%) of the designed maximum arc as indicated in manufacturers' catalog and on the plans. If there are coverage problems in unique areas, use part circle "backup heads" where there is not enough space for another row of full circle heads.

a. Slopes in excess of a three-to-one (3:1) ratio. Heads placed at the bottom of a slope need to be valved separately. Mid-point on the slope shall need a moderate amount of water and therefore these heads shall also have their own zone. Heads placed on the top of the slope must be valved separately, as they shall water for the longest period of time because this section will have no run-off from above and is exposed to more sun and wind.

Lateral lines and heads on slopes shall be installed along the contour rather than up and down the slopes.

b. Narrow strips, parking lot islands, tree lawns, and medians. Subsurface drip irrigation is encouraged in all narrow areas. **If the area is less than five feet (5') wide, use of subsurface drip irrigation is required.**

c. Zone control. Irrigated areas shall be divided into zones that have the same water requirements.

The designer shall identify all depressions, drainage ways, and stormwater detention, retention, and water quality ponds, and zone them separately from adjacent higher areas. Heads and valves shall be installed adjacent to and outside of these low areas.

All heads within a zone must have matched application rates. Heads that have different application rates shall be zoned separately. Parking lot medians and islands that are surrounded by pavement shall be located in separate zones from other landscape areas.

(5) Hydraulics.

a. Pressure loss table. A pressure loss table shall be included on the irrigation plan. The table shall include information for zones with the highest flow rate that are located the greatest distance from the source. Use seventy percent (70%) of the maximum safe water flow when calculating pressure losses for all irrigation systems. The table shall include the following information:

- Valve number and flow rate.
- Available static water pressure.
- Loss or gain due to elevation.
- Detailed list of various component pressure losses and velocities.
- The operating pressure requirements.
- Project location and date.
- Water service and meter.

### Example: Pressure Loss Hydraulic Chart

Property Name: EXAMPLE	
Project Location: AURORA	
Irrigation System Hydraulic Worksheet	
Prepared By: example	
Date 12.2.05	
Static Water Pressure: 75.00	From: of: City of Aurora
<b>Hydraulic Grade:</b>	
(Measured from backflow to valve X10)	
	Flow-GPM Loss/Gain
Svc Line: 20 LF 3" K Copper 6.10 /100FT	80.00 1.22
Water Meter: 3"	80.00 6.51
Svc Line: 30 LF 3" K Copper 6.10 /100FT	80.00 1.83
Backflow: 3" Febco 825YA Series	80.00 12.50
Master Valve:	0.00 0.00
Pressure Required at Head: Rainbird Series	30.00
Lateral Allowance:	3.50
Control Valve Allowance:	3.40
Mainline Allowance:	
@80GPM 25 LF 3" CL200BE 0.52 /100FT	0.13
@40GPM 1285 LF 2.5" CL200BE 0.38 /100FT	4.88
	/100FT 0.00
Elevation	
Tap Elevation 5106 High/Low 5116	4.33
Total System requirements (PSI)	68.30
Available Pressure (PSI)	75.00

The following table shall be used when determining meter size requirements, maximum flows and for calculating pressure losses for meters and copper pipe. The seventy percent (70%) max flow is recommended for all designs and required for all designs utilizing a meter providing both indoor and outdoor water.

### Average Flow and Pressure Losses for Displacement Type Meters and "K" Copper Pipe

Size in.	Maximum Capacity Flow Criteria		70% of Max		K Copper (C=130) Service Line Loss @ 70% Max Flow	
	GPM	PSI loss	GPM	PSI LOSS	PSI/100'	PSI/50'
3/4"	14	3.1	9.8	1.6	15.83	7.92
1"	25	3.7	17.5	1.7	11.37	5.69
1-1/2"	55	6.0	38.5	3.1	7.04	3.52
2"	100	7.8	70	3.7	5.46	2.73
3"	220	11.0	154	5.4	4.81	2.41

b. Backflow preventer and specialty valves. Maximum velocity for water flow through backflow preventers shall not exceed 7.5 Feet Per Second (FPS).

When using pressure-reducing valves, the sizing of the backflow preventer and specialty valve shall be based on the devices flow capacity at the reduced pressure level.

(6) Sizing. Mainline velocities shall not exceed five (5) FPS. Lateral line velocities shall not exceed six (6) FPS.

(7) Pressure difference. Pressure difference between any two (2) heads in the zone shall not exceed ten percent (10%) of the highest pressure within the zone.

(8) Equipment selection.

a. Spray heads. Pop-up spray heads for turf areas shall have a minimum pop-up height of four inches. A six inch (6") pop-up height shall be used adjacent to streets. The twelve inch (12") pop-up height shall be used in ground cover and flowerbeds. Heads shall seal in the operating position at ten PSI or less, and the water used in the flush mode shall not exceed .05 Gallons Per Minute (GPM). Heads shall have a ratcheting feature for adjusting the direction of spray.

Pop-up spray heads shall have built in check valves and a pressure-regulating device (set at thirty (30) PSI) installed in the base of the stem, a check valve installed in the base of the body, and under slotted plastic nozzles, with matched precipitation rate nozzles.

b. Rotary heads. Rotary heads shall be internally driven, have a closed-case rotor with wiper seals that is spring retracted. The pop-up stem surface diameter shall be less than two inches (2"), and have a minimum pop-up height of four inches (4"). All heads shall have check valves built into the bottom of the body. Small radius rotor heads shall be used for areas that range from twenty feet (20') to thirty feet (30') wide.

c. Automatic rain shut-off devices. All systems shall be equipped with an automatic rain shut-off device.

d. Automatic controllers. The following features shall be incorporated into the controller:

- Multiple programs/start times
- Water budgeting and/or spray and soak features
- Memory retention
- Battery backup
- Flexible day programming for any intervals

e. Drip irrigation. Drip irrigation is defined as subsurface low volume systems that apply water in gallons per hour (gph) through either calibrated pressure compensating emitters, bubblers, micro-sprays, and/or micro-spray pop-ups directly to a plant's root system or to a planted area.

Self-flushing, pressure-compensating subsurface drip irrigation is recommended in all planting beds that are mulched or in narrow turf strips where spray heads are not practical. All subsurface drip shall be installed in the soil, not on the surface.

As with sprinkler irrigation, drip irrigation shall be zoned for varying plant needs, slopes, and exposures.

f. Backflow prevention devices. All irrigation systems shall be equipped with an appropriate backflow prevention device.

g. Single-family detached and duplex development does not require irrigation plans review, but does require adherence to equipment requirements and inspection after irrigation installation for all irrigation installations. The following sections from the ordinance describe what is required in terms of irrigation materials

(9) Total gallons budgeted per 1,000 square feet of turf for one growing season may be calculated as:  $1,000 \times 28" \times 0.623 \text{ gal/inch} = 17,444$  gallons per growing season.

Total gallons budgeted per 1,000 square feet of plant bed per growing season may be calculated as:  $1,000 \times 15" \times 0.623 \text{ gal/inch} = 9,345$  gallons per growing season.

Table C shows the annual budgeted water in gallons for all turf areas and plant beds. The completed table shall be shown on the irrigation plan.

**Example: Calculated annual irrigation water use**

Area in turf (SF)	Area in turf x 28 in. x 0.623 = gallons applied	Area in plant beds (SF)	Area in plant beds x 15 in. x 0.623 = gallons applied
Total annual gallons applied turf + plant beds	_____ Total annual gallons		

(10) Irrigation schedule. An annual irrigation program with monthly irrigation schedules shall be shown on the irrigation plans. The irrigation schedule shall show the following information:

- Runtime.
- Number of cycles per day.
- Frequency of irrigation for each zone.

EXAMPLE CONTROLLER CHART 'A'								
Zo Plant	Zone	Prec	Zon	Peak	Weekl	Daily	Water	Design
No.	Type	rate	flow	inche	zone	zone	usage	operatin
	Description	in/hr	GP	per	run	run	gallons	pressur
				week	hours	minute	per	psi
A1	Shru Drip	0.50	4	1.00	2.00	40.00	480	30.00
A2	Shru Drip	0.50	4	1.00	2.00	40.00	480	30.00
A3	NativRotors	0.57	17	1.00	1.75	35.09	1,768	50.00
A4	Turf Pop-Up (15')	1.83	18	1.80	0.98	19.67	1,091	30.00
A5	Turf Pop-Up (8')	1.83	7	1.80	0.98	19.67	436	30.00
A6	Turf Pop-Up (15')	1.83	26	1.80	0.98	19.67	1,527	30.00
A7	Turf Pop-Up (10')	1.75	20	1.80	1.03	20.57	1,255	30.00
A8	Turf Pop-Up (12')	2.01	31	1.80	0.90	17.91	1,689	30.00
A9	Turf Pop-Up (8')	1.83	11	1.80	0.98	19.67	654	30.00
A1	NativRotors I-20	0.57	11	1.00	1.75	35.09	1,179	50.00
A1	NativRotors I-20	0.78	36	1.00	0.93	18.69	1,996	50.00
A1	Shru Drip	0.50	4	1.00	2.00	40.00	480	30.00
Total projected peak season water use per week							13,036	
Total peak season hours per week -					16.65			
Number of days/week					3			
Two (2) starts per day								



The irrigation system operator shall monitor and adjust automatic sprinklers based on the current month and available moisture. Information on efficient watering shall be available from the Aurora Water office of Water Conservation.

(11) Final construction observation. All fees for irrigation meters must be paid in full at time of system construction.

Prior to issuance of a permanent certificate of occupancy the irrigation system must be inspected by the Aurora Water Department.

Prior to inspection, the site must be free of construction debris so that components of the system can be observed. Contact information for the irrigation system installer must also be provided. Operating manuals and a recommended watering schedule must be available.

(12) Maintenance and operation requirements. A seasonal maintenance schedule beginning on April 1 through October 1 shall be shown on the irrigation plan to establish procedures for optimum irrigation efficiency and preventive maintenance practices that will conserve water resources. The maintenance schedule should include the following items:

- Check heads for coverage and leakage.
- Reprogram controllers monthly or more often if necessary according to the seasonal needs.
- Verify that the water supply and pressure are as stated in the design.
- Inspect the backflow prevention device to determine if it is working correctly.
- Periodically verify that sensors in the irrigation system are working properly.

(e) *Requirements for reclaimed domestic wastewater.* All irrigation systems installed on a site must connect to the reclaimed water system where reclaimed domestic wastewater is available meeting the requirements of the Colorado Department of Health and Environment (CDPHE), "Reclaimed Domestic Wastewater Control Regulations" and the following guidelines.

(1) Design requirements. Design requirements for irrigation systems that will connect to reclaimed domestic wastewater shall meet the following criteria:

- a. Site water containment. Reclaimed domestic wastewater shall be confined to the authorized use area, strictly minimizing runoff and/or ponding of the water. Zone slopes and microclimates to strictly minimize runoff and/or ponding of reclaimed domestic wastewater. Direct and windblown irrigation water spray shall be confined to the site. Precautions shall be taken to ensure that reclaimed domestic wastewater will not be sprayed on any facility or area not designated for application.

b. Pipe marking. Identification shall be one of the following:

- The warning "CAUTION: RECLAIMED WATER - DO NOT DRINK" embossed or stenciled on the pipe at five foot (5') intervals.
- Purple plastic marking tape the width of the pipe with the warning "CAUTION: RECLAIMED WATER - DO NOT DRINK", and taped to the pipe every ten feet (10').
- Install purple-colored pipe.

c. Outlets. All sprinkler heads, quick coupler valves, and other outlets shall have purple-colored tops or rubber covers. Permanent hose outlets are not allowed.

d. Valve boxes. All valve boxes used in the irrigation system shall have purple-colored valve box lids.

e. Irrigation controllers. Irrigation controllers shall be labeled inside and out with "CAUTION: RECLAIMED WATER - DO NOT DRINK". A laminated reduced drawing of the irrigation system shall be kept in the controller cabinet.

f. Backflow prevention. An approved reduced-pressure principle backflow prevention device or an air gap shall be provided at all potable water service connections to reclaimed domestic wastewater use areas.

g. Warning signs. Notification by clearly visible signs shall be provided to inform the public that reclaimed domestic wastewater is being used for irrigation and is not safe for drinking. The notification shall include posting of signs of sufficient size to be clearly read in all application areas and around impoundments with the following wording: ATTENTION: RECLAIMED DOMESTIC WASTEWATER - DO NOT DRINK

Signs should be in the predominant language(s) spoken in the area at the site.

These requirements are based on Colorado Department of Public Health and Environment Regulation 84, Reclaimed Domestic Wastewater Control Regulation and American Water Works Association Manual M24, Dual Water Systems.

(h) *Enforcement and penalty.* Any violation of this section shall be considered a waste of water as defined in Section 138-190 and the enforcement provisions of Section 138-190 shall apply.

Upon the issuance of any violation the system shall be adjusted within three (3) days of notification for commercial properties and within seven (7) days of notification for residential properties whenever irrigation water falls or runs

onto hard surfaces such as sidewalks, streets or driveways. Breakdowns or failures of the irrigation system shall be repaired within three (3) days of notification for commercial properties and within seven (7) days of notification for residential properties to avoid unnecessary wasting of water. Any observed or reported wasting of water may result in penalties as described by Section 138-190 of the City of Aurora Code.

## **II. Plan Review and Inspection Procedures**

The City of Aurora Ordinance requires irrigation plan submittal for all multi-family, commercial and common open space development. Irrigation plan review is not required for single family detached homes, however single family detached homes will be required to comply with the approved irrigation materials outlined in the ordinance and be subject to permitting and inspection.

**Step 1.** Design the irrigation plan(s) based on the approved stamped landscaping plans. Follow the Irrigation Plans Checklist (See Section III).

**Step 2.** Schedule a pre-submittal meeting with Water Conservation 303-326-8819. The pre-submittal meeting is recommended but not mandatory prior to plan submission.

**Step 3.** Plans will be submitted using the online submittal portal. The Irrigation Plans Examiner will notify the project representatives when the plans can be uploaded. Be sure to include at least one (1) copy of the approved landscaping plans with the irrigation plans. *All irrigation plans must be reviewed before issuance of the building permit.* An electronic .DWG file in AutoCAD or PDF is preferred.

There is a per sheet fee for the irrigation plans review (corresponding landscaping plans and a cover page will not be assessed this fee, just the irrigation sheets.) Detail sheets (required) are assessed a fee of one (1) sheet regardless of the quantity of detail sheets.

- a. Example: 10 plan sheets and 4 details sheets. Per sheet fee for this example is \$243.00:

$$(10 \times \$243.00) + (4 \times \$243.00) = \$2,673.00$$

See schedule below for plan review timelines.

**Step 4.** Upon final approval of irrigation plans, submit final approved irrigation plans in electronic .PDF format to the Irrigation Plans Examiner. The approved irrigation plans will be digitally stamped approved by the Irrigation Plans Examiner and returned to the responsible party who submitted the plans.

**Step 5.** Submit the Irrigation Permit Application to the Water Conservation Office by faxing to 720-859-4396 or by email to [tyork@auroragov.org](mailto:tyork@auroragov.org) or [stirrell@auroragov.org](mailto:stirrell@auroragov.org).

**Step 6.** After installation of the irrigation system, call 720-859-4364 to schedule an inspection. A City of Aurora inspector will perform the inspection prior to issuance of the Certificate of Occupancy. *All irrigation systems must be inspected and approved before issuance of the Certificate of Occupancy.*

Please direct any questions to: Water Conservation Division  
Phone: 303-739-7195

### **Irrigation Construction Plan Review Schedules**

<b>Irrigation Construction Plans</b>	<b>Up to 5 Sheets</b>	<b>Up to 10 Sheets</b>	<b>11+ Sheets</b>
1st Aurora review	10 days	15 days	20 days
Consultant revisions on 1st round	5 days	5 days	5 days
2nd Aurora review*	10 days	10 days	10 days
Consultant revisions on 2nd round	5 days	5 days	5 days
3rd Aurora review	5 days	5 days	5 days
<b>TOTAL weeks</b>	<b>7 weeks</b>	<b>8 weeks</b>	<b>9 weeks</b>

### **III. Irrigation Plan Checklist**

Include all of the following information in the irrigation design plans:

1. The City approved landscape plans must be included with the submitted irrigation design plan.
2. Plans must be 24"x36" and at a scale of 1"=40' or greater. The drawing must be the same scale as the corresponding approved landscape plans.
3. Irrigation systems must be designed to deliver a minimum budget of twenty-eight inches (28") (17.46 gallons) of water per square foot of turf and fifteen inches (15") (9.35 gallons) of water per square foot of plant bed per growing season. Systems must be designed to deliver this budget within three watering days per week and sixteen (16) hours per watering day window.
4. The Irrigation Design Plan shall accurately and clearly identify:
  - ❑ Property boundaries, existing and future right of way lines.
  - ❑ North arrow, title block with name of project, sheet name, company identification including address, phone number and name of person preparing plan and date.
  - ❑ Graphical and written scale - sheet size and scale to match the approved landscape plan(s).
  - ❑ Existing and proposed structures and paving.
  - ❑ Proposed grades or spot elevations in sloped or bermed areas.
  - ❑ Location, model and size of all components of the irrigation system along with typical detail sheet.
  - ❑ Static water pressure at the point of connection.

- ❑ Each zone or station shall list the:
  - Zone number.
  - Design operating pressure.
  - Flow rate.
  - Application rate (inches per hour).
- ❑ Location, number and size of water tap(s), meter(s) and backflow preventer(s).
- ❑ Location and size of each hydrozone (low, moderate, high) showing:
  - Square footage of turf areas.
  - Square footage of planting bed areas.
  - Site water requirements.
  - Method of irrigation used for each hydrozone (sub-surface, drip, micro-spray, pop up, rotor).
- ❑ Calculated Annual Irrigation Water Use table(See example below)
- ❑ Any zone(s) using non-potable water.
- ❑ Seasonal maintenance schedule.
- ❑ Pressure loss worksheet.
- ❑ Irrigation schedule showing total run times, zone run times, number of cycles, frequency of irrigation for each zone.
- ❑ Note stating **“An Irrigation and Soil Permit is required. Please call Water Conservation at 720-859-4364 to obtain your permit”**.
- ❑ **Clearly displayed registered Landscape Architect or Certified Irrigation Designer (CID) stamp**

The City of Aurora requires the irrigation system to be inspected prior to the issuance of the Certificate of Occupancy. The City will be inspecting the following:

- Installation of irrigation system per approved irrigation plans.
- Equipment types (controllers, rain shut-offs, heads, etc.).
- Proper installation of equipment. (Including proper head usage, spacing, types, alignment, depth, etc.).
- Spray coverage.
- Controller program watering schedule.