AUG 10 2023 AM10:06

RULE NO.: R161-23.13

NOTICE OF RULE ADOPTION **ADOPTION DATE: August 10, 2023**

By: Shay Ralls Roalson, P.E., Director
Austin Water

The Director of the Department of Austin Water has adopted the following rule. Notice of the proposed rule was posted on July 6, 2023. Public comment on the proposed rule was solicited in the July 6, 2023, notice. This notice is issued under Chapter 1-2 of the City Code. The adoption of a rule may be appealed to the City Manager in accordance with Section 1-2-10 of the City Code as explained below.

A copy of the complete text of the adopted rule is attached to this notice.

EFFECTIVE DATE OF ADOPTED RULE

A rule adopted by this notice is effective on August 10, 2023.

TEXT OF ADOPTED RULE

The adopted rule contains no changes from the proposed rule as shown below.

R161-23.13: Proposed revision to UCM 2.9.1, 2.9.2, 2.9.3 and 2.9.4

Rule 1 – Revisions to Utility Criteria Manual Sections 2.9.1, 2.9.2, 2.9.3, & 2.9.4

1. SECTION 2.9.1 – General Criteria for Water, Reclaimed Water, and Wastewater Systems – **Section 2.9.1.F** – Relocate and update existing Combination Air Valve (CAV) design language for water, reclaimed, and wastewater applications.
2. SECTION 2.9.2 – Water Systems – **Sections 2.9.2.B.1, B.9, B.10, B.14, B.18, and C.3** – Correct existing incorrect grammar formats.
3. SECTION 2.9.2 – Water Systems – **Section 2.9.2.B.7** – Remove old Air Release Valve language replaced by the new language in Section 2.9.1.F.
4. SECTION 2.9.2 – Water Systems – **Section 2.9.2.B.21** – Add language that requires isolation valves where mains transition from polyethylene (PE) pipe to a dissimilar pipe material to accommodate proper hydrostatic testing.
5. SECTION 2.9.3 – Reclaimed Water Systems – **Section 2.9.3.B.6** – Remove old Air Release Valve language replaced by the new language in Section 2.9.1.F.
6. SECTION 2.9.3 – Reclaimed Water Systems – **Section 2.9.3.B.9 and B.11** – Correct existing incorrect grammar formats.
7. SECTION 2.9.3 – Reclaimed Water Systems – **Section 2.9.3.B.14** – Add language that requires isolation valves where mains transition from polyethylene (PE) pipe to a dissimilar pipe material to accommodate proper hydrostatic testing.
8. SECTION 2.9.4 – Wastewater Systems – **Section 2.9.4.B.6, D.6, D.11, D.12, G.4, J.2, J.7, J.14** – Correct existing incorrect grammar formats.

9. SECTION 2.9.4 – Wastewater Systems – **Section 2.9.4.J.7.e** – Remove old Air Release Valve language replaced by the new language in Section 2.9.1.F and standardizes air valve terminology as “combination air valve” to match AWWA C512.
10. SECTION 2.9.4 – Wastewater Systems – **Section 2.9.4.J.7.l** – Add language that requires isolation valves where mains transition from polyethylene (PE) pipe to a dissimilar pipe material to accommodate proper hydrostatic testing.

SUMMARY OF COMMENTS

Austin Water did not receive comments regarding the rule adopted in this notice.

AUTHORITY FOR ADOPTION OF RULE

The authority and procedure for adoption of a rule to assist in the implementation, administration, or enforcement of a provision of the City Code is provided in Chapter 1-2 of the City Code. The authority to adopt this rule is established in Section 552.001 of the Texas Local Government Code, Section 552.017 of the Texas Local Government Code, City Code 15-9-9 and Chapter 15 of the City Code.

APPEAL OF ADOPTED RULE TO CITY MANAGER

A person may appeal the adoption of a rule to the City Manager. **AN APPEAL MUST BE FILED WITH THE CITY CLERK NOT LATER THAN THE 30TH DAY AFTER THE DATE THIS NOTICE OF RULE ADOPTION IS POSTED. THE POSTING DATE IS NOTED ON THE FIRST PAGE OF THIS NOTICE.** If the 30th day is a Saturday, Sunday, or official city holiday, an appeal may be filed on the next day which is not a Saturday, Sunday, or official city holiday.

An adopted rule may be appealed by filing a written statement with the City Clerk. A person who appeals a rule must (1) provide the person’s name, mailing address, and telephone number; (2) identify the rule being appealed; and (3) include a statement of specific reasons why the rule should be modified or withdrawn.

Notice that an appeal was filed and will be posted by the city clerk. A copy of the appeal will be provided to the City Council. An adopted rule will not be enforced pending the City Manager’s decision. The City Manager may affirm, modify, or withdraw an adopted rule. If the City Manager does not act on an appeal on or before the 60th day after the date the notice of rule adoption is posted, the rule is withdrawn. Notice of the City Manager’s decision on an appeal will be posted by the city clerk and provided to the City Council.

On or before the 16th day after the city clerk posts notice of the City Manager’s decision, the City Manager may reconsider the decision on an appeal. Not later than the 31st day after giving written notice of an intent to reconsider, the City manager shall make a decision.

CERTIFICATION BY CITY ATTORNEY

By signing this Notice of Rule Adoption R161-23.13, the City Attorney certifies that the City Attorney has reviewed the rule and finds that adoption of the rule is a valid exercise of the Director's administrative authority.

REVIEWED AND APPROVED

Shay Ralls Roalson

Date: 8/7/2023

Shay Ralls Roalson, P.E. Director
Austin Water

Anne L. Morgan

Date: 8/9/2023

Anne L. Morgan
City Attorney

2.9.1 General Criteria for Water, Reclaimed Water, and Wastewater Systems

A. Easements

1. Easements for water, reclaimed, and wastewater infrastructure shall be a minimum of 15 feet wide, or twice the depth of the infrastructure, measured from finished grade to infrastructure flowline, whichever is greater. Infrastructures shall be centered on the easement. Narrower easements will be considered where the Engineer provides evidence, to the satisfaction of AW, that maintenance activities will not be hindered by the reduced width. If fill is placed over an existing easement, the easement width will need to be adjusted to meet the minimum width requirements. When water, reclaimed water and wastewater infrastructures are located outside of the right-of-way, they shall be within a dedicated utility easement. See UCM 2.9.1.A.4 for exclusive water utility vault easement requirements.

2. Easement documents and the metes and bounds shall be reviewed and approved by AW Pipeline Engineering prior to recordation in the real property records of the appropriate county. Easement recordation in the real property records of the appropriate county is required prior to AW approval of construction plans.

3. Private plumbing may cross a Public Utility Easement (PUE) or easement created for the purpose of installing underground public utilities, perpendicular or no more than 45° from the perpendicular. At no time shall private plumbing be allowed to run in parallel with and within the easement boundaries.

4. All AW vaults within the ROW or easements require a minimum 5-foot exclusive space around and under the vault structure. With exception of an associated irrigation service, all other existing or proposed underground utilities, appurtenances, and structures shall adhere to this exclusive space criteria. AW maintained vaults outside of the ROW shall utilize an Exclusive Water Line Vault Easement.

B. Horizontal and Vertical Separation Distance

1. Main assignments in city streets must be coordinated with the AULCC. Assignments for these mains in county roads must also be approved by the county engineer. The separation between these mains must comply with the TCEQ rules. Assignments for these mains to be located within State or Federal Highway Right-of-Way shall also be approved and permitted by the Texas Department of Transportation (TxDOT). All

separation distances shall be from outside diameter of the pipe to outside diameter of the pipe (OD to OD).

2. A minimum horizontal separation of 5 feet shall be maintained between existing or proposed AW infrastructure and all other non-AW infrastructure in order to maintain trench integrity. On residential development projects, a minimum horizontal separation of 3 feet may be allowed between water, reclaimed water and wastewater service lines and dry utility service lines.

3. A minimum vertical separation of 12 inches (or 6 inches, only if approved by AW due to an unavoidable utility conflict) shall be maintained when water, reclaimed water and wastewater mains are located above non-AW infrastructure. Regardless of the vertical separation, the bedding of an existing water, reclaimed water and wastewater main, if disturbed, shall be reestablished using Controlled Low Strength Material (see Standard Specification Item 402S) that completely fills the excavation beneath the main and extends vertically to the spring line of the main.

   A minimum vertical separation of 18 inches (or 12 inches, only if approved by AW due to an unavoidable utility conflict) shall be maintained when water, reclaimed water and wastewater mains are located below non-AW infrastructure. When a new water or reclaimed water main crosses under an existing wastewater main or lateral, the water or reclaimed water main shall be encased in steel encasement at least 18 feet in length centered on the wastewater main and the encasement shall contain full-circumferential welded joints. No other form of encasement, including cement stabilized sand, will be allowed. A minimum vertical separation of 12 inches shall be maintained between the existing wastewater main and the top of the pipe within the steel encasement. When a water, reclaimed water or wastewater main is below 42 inches or larger storm drain, the main shall be steel encased with a minimum vertical separation of 18 inches between the top of the pipe within the steel encasement and storm drain. The encasement shall extend horizontally a minimum of 5 feet beyond the OD or edge of the storm drain. A minimum vertical separation of 18 inches shall be maintained for utility crossings by trenchless methods when crossing above water, reclaimed water and wastewater mains. See UCM 2.9.2.B.17 for instructions on trenchless methods when crossing under water mains. Regardless of the vertical separation, any bedding material for an existing water, reclaimed water and wastewater main above or beside the main that has been removed or disturbed shall be replaced with bedding material meeting Standard Specification Item 510 to a depth of at least 12 inches above the top of the main.

C. Location of Mains and Services in the Proximity of Street Trees and Planting Zones.

"Street Tree Utility Gap/Utility Gap" refers to the area between street tree planting zones where utility services will be located.

Where Street Trees are placed within the right-of-way, root barriers shall be placed on all sides of the planting zone where AW mains and/or services are located. Root barriers shall be installed no closer than 7 feet from the tree trunk. Utilities shall be placed no closer than 2 feet from the root barrier. In no circumstances shall utility infrastructure be placed within the planting zone. Where "Street Tree Utility Gaps" are located between planting zones, the gap shall be a minimum of 8 feet wide between root barriers. Additional width will be required to allow for multiple utilities to be placed within the "utility gap."

D. Encasement Piping.

Encasement piping less than 24 inches diameter shall begin and end no closer than 3 feet to an adjacent appurtenance or connection. Encasement piping 24 inches diameter and larger shall begin and end no closer than 5 feet to an adjacent appurtenance or connection."

E. Structures in the Right of Way and In Easements

The design and construction of retaining walls, bridges, culverts, headwalls, junction structures, screening walls, and stormwater drainage pipe within the vicinity of AW utilities shall be in compliance with SECTION 13 of the COA's Transportation Criteria Manual.

F. Combination Air Valves

The Engineer is responsible for determining where combination air valves (CAVs) are necessary to assure the piping system operates properly based upon the specific system characteristics. Minimally, on water mains 16 inches in diameter and larger and on smaller mains where appropriate, CAVs shall be placed at all high points and on the down-slope side of all isolation valves located on the main. On all reclaimed mains and force mains (4" diameter and larger), CAVs shall be placed at all high points and on the down-slope side of all isolation valves located on the main. When required, use of air-release and air/vacuum valves shall be approved on a case-by-case basis. An air collection trap in the form of a vertical flanged outlet shall be installed on the main pipe leading to each CAV connection in order to capture passing pockets of air and wastewater gases. When installed at a high point, the CAV shall be installed on a horizontal segment of pipe.

The size of the air collection trap shall conform to the following Table:

Main Size	*Air Collection Trap Outlet Size (diam)*
8-inch	*8-inch*
12-inch	*12-inch*
16-inch	*12-inch*
24-inch	*16-inch*
30-inch	*20-inch*
36-inch	*20-inch*
42-inch	*20-inch*
48-inch	*20-inch*

CAVs on mains up to and including 24-inches shall contain a 2-inch orifice unless otherwise approved. For mains 30-inches and larger, the Engineer shall also determine the CAV orifice size based on a 30% partial rupture as calculated by AWWA M51, Chapter 4. The Engineer shall provide calculations determining the size of valves for review by AW when requested.

2.9.2 Water Systems

B. Mains

1. While looped systems are required, it is recognized that in certain situations, installation of ~~dead~~ ***dead-***end pipe may be necessary. When a ~~dead~~ ***dead-***end section of water main is approved for installation, the following requirements must be met:

   a. A gate valve shall be installed near the end of the main followed by an appropriate length of one joint of restrained pipe and a plug with a 1 inch or larger tap. Thrust blocking shall not be used as restraint at the end of the main. The engineer shall determine the necessary length of restraint on each side of the valve that will keep the main in place for future extension when the plug is removed. No services may be installed between the valve and the plug.

   b. Adequate water circulation must be provided to achieve turn-over of water in the dead end main every 72 hours. Until such time as water demand from active services on the ~~dead~~ ***dead-***end section of main results in the ~~72~~ ***72-***hour turn over, an approved automatic flushing device must be installed and programmed such that the ~~72~~ ***72-***hour criterion is met.

2. Water mains should normally be located on the high side of the street. When required to satisfy 2.9.2.D.9, 2.9.2.E.8, or 2.9.3.D.10, water mains shall be installed on both sides of divided roads or highways. Divided roads or highways are where opposing lanes of vehicular traffic are currently or planned to be separated by a median, railroad tracks, or other vehicle obstruction.

3. Piping materials and appurtenances shall conform to COA Standard Specifications and AW's Standard Products List (SPL).

4. Minimum depth of cover over the uppermost projection of pipe shall be at least 48 inches below proposed ground elevation. If fill or embankment placed over existing water mains or services exceeds 4 feet or results in a final depth exceeding two times the easement width if applicable, AW review and approval is required. If a cut over the existing mains or services results in less than minimum cover, AW approval is required. If manholes, valves, hydrants, meters, cleanouts, etc. are located within the cut or fill area(s), adjustment must be made to match final grade and plans must be reviewed and approved by AW and the construction inspected by the City. If the fill is located on top of an existing easement, see Section 2.9.1.A.1.

5. For mains 16 inches in diameter and larger and on smaller mains where appropriate, hydrants or drain valves shall be placed at low points and on the up-slope side of all valve locations.

6. All fire lines shall have a gate valve on the line at the connection to the main line and a backflow preventer inside the property line, but accessible for inspection by City personnel. All unmetered fire lines shall have an AW approved flow detection device. This flow detection service shall be located such that no more than 100 gallons of water is contained between the device and the point where the fire line is connected to the City's main.

7. ***RESERVED .***~~The Engineer is responsible for determining the size and type of air release valves necessary to assure the water system operates properly based upon the water system characteristics and shall provide calculations determining the size and type of valves for review by AW when requested. Air release valves may be necessary on any size of main. Minimally, on~~

~~water mains 16 inches in diameter and larger and on smaller mains where appropriate, combination air valves will be placed at all high points and air/vacuum valves shall be placed at the down-slope side of all gate valve locations. Air/vacuum and vacuum release valves shall be approved on a case-by-case basis. All mains 24 inches and larger will include an 18-inch outlet with flange including a 1-inch corporation (minimum) for installation at high points where the installation of an air release valve (ARV) would be necessary. In the absence of an ARV requirement, an 18-inch outlet with flange including a 1-inch corporation shall be placed every 2,500 feet. Proposed waterline connections to air release valve piping are prohibited.~~

8. Joint restraint for pipes larger than 24 inches diameter shall be by use of integral, factory joint restraint systems. External mechanical joint restraint devices are allowed at all sizes of valves and fittings. Joint restraint for ductile iron pipes 24 inches and smaller may be by joint restraint gaskets.

9. Joint restraint shall be provided for all pipe bends and where necessary when joint deflection is utilized. A minimum safety factor of 1.5 shall be used when calculating restrained water pipe length. When joint restraint is required in intersections, extend the joint restraint, at a minimum, to the point of curvature (PC) of the curb line. Notes shall be placed in both plan and profile views and shall include at a minimum the type of restraint to be utilized and the beginning and ending stations of the restraint. Cast Iron and Asbestos Concrete Pipes cannot be mechanically restrained and shall be removed and replaced with Ductile Iron Pipe or PVC C-900 pipe to ensure adequate restraint. Concrete thrust blocking may be approved on a ~~case by case~~ ***case-by-case*** basis. In cases where concrete thrust blocks are utilized, at a minimum the Engineer shall include block dimensions and locations on the plans. The proximity of other utilities and structures must be taken into account when specifying the use of thrust blocking. The use of thrust blocks will be prohibited in the downtown area (Loop 1 to I35 and Lady Bird Lake to 30th Street). All pipes, valves, and fittings, greater than 2 inches in size, installed in the TxDOT Right-of-Way (ROW), Austin Bergstrom International Airport (ABIA) property and University of Texas property shall be restrained ductile iron pipe.

10. Allowable pipe sizes. The following sizes will be the only sizes allowed for new watermains: 4 inches (see Section 2.9.2.A.4.a), 6 inches (fire-hydrant leads and services only), 8 inches, 12 inches, 16 inches, 24 inches, 30 inches, 36 inches, and 42 inches. Larger sizes may be approved on a ~~case by case~~ ***case-by-case*** basis.

11. Connections 4 inches and larger of new mains to existing mains shall be made by cutting in a tee. Tapping sleeves may be allowed in lieu of cutting in a tee on a case-by-case basis. Full-body tapping sleeves shall be used. A tapping sleeve will not be allowed if the materials and conditions of the existing main preclude tapping. "Size on size" taps will not be permitted, unless made by use of an approved full bodied mechanical joint tapping sleeve. Reconnection to existing tapping sleeves shall not be allowed.

12. Wyes are not allowed on waterlines.

13. The maximum bend for waterlines is 45 degrees.

14. All potable water mains shall be constructed of ductile iron or PVC pipe. For ductile iron pipes, Pressure Class 350 minimum for pipe 12-inch diameter and smaller and Pressure Class 250 for pipes greater than 12-inch diameter shall be used. For PVC pipe 16-inch diameter and smaller conforming to the requirements of AWWA C-900, DR 14 shall be acceptable. Alternative pipe materials may be considered on a ~~project by project~~ ***project-by-project*** basis.

15. All potable water pipe within utility easements on private property shall be Ductile Iron Pipe, Pressure Class 350 minimum for pipe 12-inch diameter and smaller and Pressure Class 250 minimum for pipes greater than 12-inch diameter. AWWA C-900 pressure class 305 (DR14) potable water line pipe may be considered to be installed within utility easements on private property only when it meets the following criteria:

    a. The finished surface of the water line easement over the potable water line must be paved. Where the water pipe is under HMAC or Portland cement concrete pavement designed structurally for automobile and truck traffic per the Geotechnical report, PVC pipe may be allowed just in those paved areas, provided it can be demonstrated that the pipe will not be damaged by construction traffic if it does not maintain a minimum of 48 inches of cover.

    b. The potable water line must maintain a minimum 48 inches of cover over the uppermost projection of pipe to the finished grade.

    c. The plan and profile must clearly identify the potable water line size, material type and class as well as the paved finished grade.

16. Changes in alignment in water lines, both horizontal and vertical, shall be achieved by deflection of joints or by use of fittings. Deflection of pipe joints at fittings is only allowed on ductile iron pipes. Longitudinal bending of pipe is not allowed. Deflection of joints in ductile iron pipe shall not exceed manufacturer's maximum allowable deflection. For PVC pipe, the deflection at pipe joints shall not exceed 1°, or the manufacturer’s maximum allowed deflection, whichever is less.

17. Utility crossings constructed under water lines by trenchless methods are allowed only if the distance between the outside surface of the water line and the top, crown, or roof of the excavation made for the crossing utility is at least two times the diameter or horizontal span of the trenchless excavation below the water line, or 36 inches, whichever is larger. The trenchless method shall support the advancing face and roof or crown of the excavation at all times when within a horizontal distance of 10 feet of the water line.

18. Utility crossings constructed under water mains by open cut methods are not allowed if the water main consists of asbestos cement pipe or ~~cast iron~~ ***cast-iron*** pipe with lead caulk joints. In those instances, the main must be removed and replaced to accommodate construction of the subject utility. Replacement will be with new pipe of the type currently used in the AW system for comparable size pipe. In lieu of replacing the main, the Engineer may provide a design detail showing how the main shall be supported during the open cut method when the trench under the water main is 3 feet or less in width.

19. Bedding and backfill for that portion of a utility installed by open cut construction under and within 5 feet horizontally of a water main shall be made using controlled low strength material from the bottom of the subject utility to the bottom of the bedding envelope of the water line even if that water line is removed and replaced as described above.

20. Connections to Concrete Steel Cylinder Pipe.

    a. Special Details are required to show materials and method of connecting proposed water mains to existing Concrete Steel Cylinder, or CSC, water mains.

    b. Connections to Bar-Wrapped CSC Pipe shall be made by cutting and removing an appropriate pipe segment, and replacing with Ductile Iron fittings, valves, or pipe, using appropriate CSC to DI steel transition adapters and steel butt straps.

c. Connections to Prestressed Concrete Cylinder Pipe shall be by removing entire pipe segments, joint to joint, and replacing with Ductile Iron pipe or welded steel pipe, as designated by AW, using appropriate bell-to-Mechanical Joint Plain End (MJPE) and spigot-to-MJPE transition adaptors.

21. Where mains transition from polyethylene (PE) pipe to a different pipe material (ductile iron pipe, PVC pipe, etc.), the PE pipe segments shall be designed to undergo hydrostatic testing separately from the segments of different pipe material by way of isolation valves or other means.

2~~1~~*2*. Mains shall be located so that isolation valves, air valves, and hydrants will be readily accessible during their service life for maintenance and operations personnel and equipment.

C. Valves (gate valves for isolation purposes)

1. There shall be a valve on each fire hydrant lead restrained to the main using bolt-through types of connections between the valve and the branch outlet from the main. These and all valves 24 inches and smaller shall be resilient seated gate valves.

2. Valves shall be located at the intersection of two or more mains and shall be spaced so that no more than thirty customers will be without water during a shutout. Water mains designated by Systems Planning for distribution, up to and including 24 inches in diameter, shall be valved at intervals not to exceed 500 feet in high-density areas and 1,200 feet in residential areas. Water mains 24 inches and larger designated by Systems Planning for transmission shall be valved at intervals not to exceed 2,000 feet or at a branched water main connection, whichever is less. High density areas shall consist of inside the Downtown Area Project Coordination Zone, commercial areas CBD, DMU, W/LO, CS, and CH or residential areas mixed with multifamily (MF) zoning designations MF-4, MF-5, and MF-6 as defined and described in the Land Development Code.

3. For valves at the end of ~~dead~~ ***dead-***end mains, see Section 2.9.2.B.1.a.

4. Branch piping (both new and future branches) shall be separated from the main with gate valves.

5. For all mains, valves at intersections shall be placed at point of curvature (p.c.) of the curb line.

6. Valves shall be located so that isolating any segment of water main requires closing of no more than three valves.

7. The operating nut or extension of any valve shall be between 18 inches and 24 inches below finished grade.

8. Valves with valve extensions and those at pressure zone boundaries shall be equipped with a locking type debris cap.

9. Each valve that is 16 inches and smaller in diameter shall be supported by a pre-cast or cast-in-place concrete pad conforming to details in COA valve installation Standards. Each valve that is 24 inches and larger in diameter shall be supported by a monolithic, cast-in-place reinforced concrete foundation conforming to project-specific detailed structural drawings. Cast-in-place supports shall not interfere with access to any nuts or bolts at the connecting pipes.

10. Valves having "push on" joints are not permitted for fire hydrant leads and laterals.

11. Butterfly valves shall not be allowed.

12. Water mains shall be designed so that valves can be installed vertically unless conditions dictate otherwise.

13. Water mains installed under TxDOT ROW, railroad ROW, or any flowing or intermittent stream, creek, river or semi-permanent body of water (water crossing), except when installed by horizontal directional drilling technology (or HDD), shall be installed in a steel pipe encasement with spacers, pipe joint restraint and factory end seals. The crossing design shall include the installation of a drain valve assembly at the lowest point in the crossing, and an isolation valve at the high point on each side of the crossing with a CARV installed on the downslope side of each valve.

    Water crossings shall conform to current COA Erosion Hazard Zone (EHZ) crossing criteria.

14. Valve operators shall be located a minimum of 24 inches from an existing property line.

15. Valves, regardless of their intended purpose, shall be located so that during their design service life they will be readily accessible for maintenance and operations personnel and equipment.

2.9.3 Reclaimed Water Systems

B. Mains

1. Sizing of Mains - Computer modeling is preferred for sizing reclaimed water mains. However, for mains less than 16 inches in diameter other engineering calculation methods may be accepted. Standard main sizes are: 6 inches, 8 inches, 12 inches, 16 inches, 24 inches, 30 inches, 36 inches, 42 inches, and 48 inches.

2. Reclaimed water mains shall be constructed of ductile iron pipe, Pressure Class 350 minimum for pipe 12-inch diameter and smaller and Pressure Class 250 for pipe greater than 12-inch diameter. PVC pipe 16-inch diameter and smaller conforming to the requirements of AWWA C-900, DR 14 shall also be acceptable. Plans shall indicate that all mains and appurtenances shall be manufactured in purple, factory painted purple or bagged in purple. Color shall match Pantone 522.

3. Piping materials and appurtenances shall conform to City of Austin (COA) Standard Specifications, Standard Details, and AW Standard Products List (SPL).

4. Minimum depth of cover over the uppermost projection of the pipe and all appurtenances shall comply with COA Standard Details. Maximum depth will be approved by AW for the specific materials, application and conditions. If fill or embankment placed over existing reclaimed water mains or services increases by more than 4 feet or results in a final depth exceeding two times the easement width if applicable, AW review and approval is required. If a cut over the existing reclaimed water mains or services results in less than the minimum cover required by COA Standard Details, AW approval is required.

5. For mains of 16 inches and larger, drain valves shall be placed at low points.

6. ***RESERVED.*** ~~On mains 12 inches in diameter and larger, automatic air release valves will be placed at all high points. Mains larger than 16 inches shall have an automatic air release valve placed at the down-slope side of all valve locations. Air/vacuum and vacuum release valves shall be approved on a case-by-case basis. All reclaimed mains 24 inches and larger will include an 18 inches outlet with blind flange installation at high points where the installation of an ARV would be necessary. In the absence of an ARV requirement, an 18 inches outlet with blind flange shall be placed every 2,500 feet.~~

7. Dead-end mains shall terminate with a flushing device and flushing devices shall be installed as necessary to facilitate flushing of the system.

8. Mains shall have an approved flushing device located at the high point between main intersections.

9. Joint restraint for pipes larger than ~~16~~ ***16-***inch diameter shall be by use of integral, factory joint restraint systems, or by restraint gaskets.

10. Joint restraint shall be provided for all pipe bends, reducers, and tees. When joint restraints are required in intersections, the joint restraints shall extend, at a minimum, to the point of curvature (PC) of the curb line. Notes shall be placed in both plan and profile views and shall include at a minimum the type of restraint to be utilized and the beginning and ending stations of the restraint.

11. The proximity of other utilities and structures must be taken into account when specifying the use of thrust blocking. The use of thrust blocks will be prohibited in the downtown area (Loop 1 to I35 and Lady Bird Lake to 30th Street) due to the congestion of utilities, structures and excavations in the right-of-way. Concrete thrust blocking may be approved on a ~~case by case~~ ***case-by-case*** basis.

12. Connections of new reclaimed mains to existing reclaimed mains shall be made by cutting in a tee. Tapping sleeves may be allowed in lieu of cutting in a tee on a case-by-case basis. Full-body tapping sleeves shall be used. A tapping sleeve will not be allowed if the materials and conditions of the existing main preclude tapping. "Size on size" taps will not be permitted, unless made by use of an approved full bodied mechanical joint tapping sleeve.

13. Deflection of joints in ductile iron pipe shall not exceed manufacturer's maximum allowable deflection. For PVC pipe, the deflection at pipe joints shall not exceed 1°, or the manufacturer's maximum allowed deflection, whichever is less.

14. Where mains transition from polyethylene (PE) pipe to a different pipe material (ductile iron pipe, PVC pipe, etc.), the PE pipe segments shall be designed to undergo hydrostatic testing separately from the segments of different pipe material by way of isolation valves or other means.

1~~4~~***5***. Mains shall be located so that isolation valves, air valves, and flushing devices will be readily accessible during their service life for maintenance and operations personnel and equipment.

2.9.4 Wastewater Systems

B. Determination of Pipe Size.

1. Minimum Size.

   The minimum diameter of all gravity sewer mains shall be 8 inches. For service line sizes, refer to the City of Austin Standard Details.

2. Design Requirements.

   For sewer mains, 15 inches in diameter or smaller, use the larger size as determined below:

   a. The main shall be designed such that the PDWF shall not exceed 65% of the capacity of the pipe flowing full.

   b. The main shall be designed such that the PWWF shall not exceed 85% of the capacity of the pipe flowing full.

   c. For sewer mains, 18 inches in diameter or larger, the main shall be designed such that the PWWF shall not exceed 80% of the capacity of the pipe flowing full.

3. Minimum Design Velocities.

   The minimum design velocity calculated using the PDWF must be at least 2 feet per second (fps). If a minimum velocity of 2 fps cannot be achieved due to the low projected wastewater flows, velocities lower than 2 fps at PDWF may be allowed provided that all of the following requirements are met:

   a. The Engineer substantiates in writing and to the satisfaction of Austin Water (AW) that is not possible to meet the 2 fps velocity at PDWF.

   b. A minimum of 0.01 ft./ft. (1.0 percent grade) is provided.

4. Maximum Design Velocities.

   The maximum design velocity calculated using the PWWF should not exceed 10 fps. Velocities in excess of 10 fps may be considered under special conditions where no other options are available. In such cases, proper consideration shall be given to pipe material, abrasive characteristics of the wastewater flows, turbulence and displacement by erosion or shock.

5. Minimum Slope.

   The minimum allowable slope for 8-inch mains within the service area of the City of Austin shall be 0.005 ft./ft. (0.5 percent grade) unless otherwise required by 3.b of this section.

6. Allowable pipe sizes.

   The following sizes will be the only sizes allowed for use in the gravity system: 6 inches (for services only), 8 inches, 12 inches, 15 inches, 18 inches, 24 inches, 30 inches, 36 inches, 42 inches. Larger sizes may be approved on a ~~case by case~~ ***case-by-case*** basis. These pipe sizes do not apply to force mains.

C. Design Considerations.

1. Materials and Standards.

All materials and appurtenances shall conform to the AW Standard Products List.

2. Protecting Public Water Supply.

   No physical connection shall be made between a drinking water supply and a sewer or any appurtenance thereof. An air gap of a minimum of two inlet pipe diameters between the potable water supply and the overflow level connected to the sewer shall be provided.

3. Location.

   The location of the wastewater main shall be in conformance with the City of Austin (COA) Standard Details Manual. Alternative assignments must be approved by AW Utility Development Services (UDS) - Pipeline Engineering. Outside the City Limits, the design engineer shall coordinate utility assignments with both AW and the appropriate county authority.

4. Steep grades.

   Where the pipe grade exceeds 12% and the construction is outside of any pavement, concrete retards conforming to the City standards will be required at intervals of no more than 25 feet (preferably at joint locations).

5. Depth of Cover.

   If fill or embankment placed over existing wastewater mains exceeds 4 feet above the existing ground, AW approval is required. If cuts exceed the minimum depth of cover stated below, AW approval is required. The minimum depth of cover over the upper-most projection of the main shall be as follows:

   a. Wastewater piping installed in natural ground in easements or other undeveloped areas which are not within existing or planned streets, roads or other traffic areas, shall be laid at least 42 inches below ground elevation.

   b. Wastewater piping installed in proposed streets, existing streets, roads or other traffic areas shall be laid at least 66 inches below proposed ground elevation.

6. Turbulence.

   Wastewater lines shall be designed to minimize turbulence to prevent release of sulfide gases and subsequent corrosion.

7. Wastewater lines are prohibited in a critical water quality zone, except for a necessary crossing.

8. Curved wastewater mains are prohibited.

D. Manholes.

1. Location.

   Manholes shall be located and spaced so as to facilitate inspection and maintenance of the wastewater main. All manholes must be accessible to maintenance equipment, including 2½ ton straight trucks, dump trucks, vacuum trucks, and standard (not compact) sizes of backhoes and loaders. In isolated cases, construction of all-weather access roads may be necessary for manhole and/or wastewater line access. If required, design guidance is provided in Section 2.9.4.D.12. Manholes shall be placed at the following locations:

   a. Intersections of mains.

b. Horizontal alignment changes.

c. Vertical grade changes.

d. Change of pipe size.

e. Change of pipe material.

f. The point of discharge of a force main into a gravity wastewater main.

g. For multi-family projects exceeding 15 dwelling units and for commercial developments containing more than 4,000 square feet of air conditioned space and requiring a water meter greater than 2 inches, a manhole is required on the main at the point of connection to the wastewater service.

h. At the upstream end of mains.

i. At other locations as required by City Code.

2. Spacing.

Manhole spacing for lines smaller than 24 inches should not exceed 500 ft.; for larger mains, spacing may be increased, subject to approval by the Utility.

3. Covers.

a. All manholes located in unpaved areas or in the TCEQ Edwards Aquifer Recharge Zone (EARZ) shall have bolted, watertight covers.

b. When existing manholes are adjusted in height to match finished surface elevations, the most current manhole ring and cover size shall be utilized. This may require removal and replacement of the existing manhole cone section to facilitate the above work.

4. Corrosion Prevention.

Manholes shall be constructed of or lined with a corrosion resistant material. Where new construction ties into an existing manhole, the existing manholes must be lined, coated, or replaced with a corrosion resistant material. The Design Engineer shall provide an AW Manhole Inspection report for Wastewater Manhole replacement or rehabilitation for both CIP and non-CIP projects.

5. All lines into manholes, including drop connections, shall match crown-to-crown where feasible. Any deviation must be approved in advance by AW UDS - Pipeline Engineering.

6. Drop manholes are not allowed where the size of the incoming main requiring the drop exceeds 15 inches diameter. External drops will be limited to a depth of 15 feet from the lid of the manhole to the base. Drop manholes in excess of 15 feet deep must be designed with an internal drop and must be a minimum size of ~~5 foot~~ ***5-foot*** diameter.

7. Minimum inside manhole diameters shall be as indicated in the following table:

Main Size	Depth		
	Less than 20′	20′—30′	Greater than 30′
Up to 15″	48″	60″	72″
18″—24″	60″	60″	72″
30″ and 36″	72″	72″	72″

Note 1: In the event a structure is utilized inside a manhole, the clear space between the structure and the manhole wall shall be a minimum of 48 inches.

Note 2: If more than two mains connect to a manhole, or if two mains connect to a manhole at an angle other than 180 degrees from each other, a larger diameter manhole may be required in order to accommodate mandrel insertion and hydraulically efficient flow. A straight section of invert that is 4 inches to 6 inches in length is required to transition between the curved portion of the invert channel and the connecting pipes in order to accommodate the mandrel apparatus for up to 15-inch diameter pipes.

Note 3: New pipe connections to existing manholes shall provide a minimum of 12 inches clearance between the existing pipe ID and the new core hole ID measured on the inside surface of the manhole, regardless of the orientation of the pipes with respect to one another. New precast manholes and manholes with cast-in-place bases shall have holes for pipe penetrations in the manhole wall separated by a minimum of 7 inches, designed by the manhole manufacturer and as measured from the inside diameter of the cored holes on the inside wall of the manhole to ensure the structural integrity of the manhole wall.

Note 4: The vertical distance between the highest point of the invert shelf and the bottom of any horizontal or near-horizontal surface protruding into a manhole or junction box, shall be at least 6 feet, when the depth of the main is sufficient.

8. Where a separation of 9 feet between an existing water main and a new manhole cannot be achieved during construction of a new wastewater main the joints in the wastewater manhole shall be made watertight using externally applied joint wraps. Where a separation of 9 feet between a water main and an existing manhole cannot be achieved during construction of a new water main, the manhole shall be assessed as per Section 2.9.4.D.4 to determine if the manhole is watertight and if not, the manhole shall be made watertight.

9. Manholes constructed on existing wastewater mains may have a cast-in-place base. All other manholes shall have a precast base.

10. Manhole and junction box inverts shall have a minimum slope of 2.5% between the inlet and outlet pipe inverts.

11. Manholes and junction boxes located below ground water.

    a. When the interior surface of a concrete manhole or junction box is coated with a urethane, polyurethane, or epoxy liner, the exterior surface of that portion of a manhole or junction box located below ground water level shall be ~~water proofed~~ ***waterproofed*** using a flexible system applied to the exterior surface. The drawings shall indicate which structures must be ~~water proofed~~ ***waterproofed*** and the elevation to which water proofing must be applied (2 feet above ground water level).

    b. Manhole joints below the ground water level and/or located in the 100-year floodplain shall be sealed by installing a joint wrap material over the joint on the manhole exterior.

    c. Construction joints in cast-in-place junction boxes shall be ~~water proofed~~ ***waterproofed*** using water stops.

12. All-weather access roads should be at least 12 feet wide and placed within a 20-foot wide (minimum) access easement. It is intended for emergency use by maintenance equipment. If the

wastewater easement is wide enough to accommodate the access road, it may be used in lieu of an access easement. This 12 foot maintenance access road should be outside the toe of any fill slope and the top of any cut slope and shall not have a post construction longitudinal slope greater than 15% nor a post construction transverse slope greater than 5%, shall not have a vertical grade break of greater than 12%, should have an inside turning radius of no less than 28.3 feet, an outside turning radius of no less than 42 feet, shall be cleared of all vegetation and graded, and should maintain a horizontal and vertical clearance from existing and proposed vegetation and all other objects of no less than 14 feet.

The access road shall include a means for equipment to turn around when located more than 200 feet from a paved public roadway. Turn around shall meet the above listed design criteria. Access roads shall be cleared, graded and stabilized with stones in accordance with Standard Detail 662S-2, Pond Maintenance Road Typical Cross Section. Other materials and geometrics may be approved on a ~~case by case~~ ***case-by-case*** basis by AW.

13. If a proposed development intends to connect to an existing brick manhole, the manhole will need to be removed and replaced.

E. Ventilation.

Ventilation shall be provided as required by TCEQ Rules and Regulations.

F. Inverted Siphons.

The use of siphons is discouraged. When no other feasible option exists, the following criteria apply. Siphons shall have a minimum of two barrels. The minimum pipe size shall be 6 inches with a minimum flow velocity of 3.0 fps at peak dry weather flow. The minimum dry weather flow shall be used to size the smallest barrel. Three-barrel siphons shall be designed to carry the capacity of the incoming gravity wastewater main(s) with one barrel out of service.

An additional corrosion resistant pipe shall be designed to allow for the free flow of air between the inlet and outlet siphon boxes. The diameter of this air jumper shall not be smaller than one-half the diameter of the upstream sewer. Air jumper pipe design shall provide for removal of condensate water that will collect in the pipe.

Siphons shall be designed to allow draining, cleaning, and diversion of flow from individual barrels and inspection. Siphon inlet and outlet structures shall be manufactured with polymer concrete.

G. Service Lines.

1. Wastewater services shall be in accordance with COA Standard Details.
2. Wastewater service lines, between the main and property line, shall have an inside diameter not less than 6 inches. The minimum grade allowed for service lines is 1 percent. In all new systems, grade breaks exceeding allowable joint deflection must be made with approved fittings and shall not exceed a cumulative total of 45 degrees.
3. No service connections shall be made to mains larger than 15 inches in diameter.
4. Service connections to force mains that are 2 inches in diameter and smaller may be allowed on a ~~case by case~~ ***case-by-case*** basis. Service connections to force mains that are larger than 2 inches in diameter shall not be allowed.
5. Potable water and wastewater service lines shall be a minimum of nine feet apart unless the potable and wastewater service lines are located on a common lot line and constructed in

accordance with COA Standard Details per TCEQ rules. Services to lots without a water/wastewater easement shall terminate at the property line with a 2-way cleanout. Service to lots having a 5 feet by 5 feet water/wastewater easement shall terminate within the easement with a 2-way cleanout. A 2-way cleanout shall be installed for service lines 4 inches to 6 inches in diameter, and a large diameter cleanout shall be installed for service lines 8 inches to 12 inches in diameter. For service lines larger than 12 inches in diameter, contact Industrial Waste for design requirements. For details, see the COA Standard Details.

6. Wastewater clean-outs are not allowed in sidewalks, paved areas, load bearing pavement, or driveways.

7. Sample and inspection ports are required for service lines when industrial waste monitoring is required. They shall be located at the property line within the public right-of-way (ROW) or utility easement line to indicate the line of responsibility of the utility. They shall not be located in traffic areas, paved parking areas or sidewalks.

H. Reserved.

I. Requirements for Existing and Proposed Wastewater Infrastructure beneath Circular Intersections or Other Geometric Street Features.

1. Installation of Circular Intersections or Other Geometric Street Features over existing wastewater infrastructure.

a. Existing wastewater infrastructure may be allowed to exist beneath circular intersections or other geometric street features such as, but not limited to, modern roundabouts, medians, bulb-outs, splitter islands, channelization islands, and other types of physical roadway features. These features may contain hardscaping, landscaping, water quality features, public art, permanent structures, street furniture, or other similar amenities.

b. The planning and design of these features and their amenities shall include consideration for access, maintenance, protection, testing, cleaning, and operations of the wastewater infrastructure. Where existing wastewater facilities are to remain, trees with root zones of 18 inches in depth or greater at maturity may be considered for inclusion provided the drip lines at maturity of the proposed trees are not located within a minimum horizontal separation of 7.5 feet from any wastewater infrastructure. Public art, permanent structures, and other similar amenities may be considered for inclusion provided they are not located within a minimum horizontal separation of 7.5 feet from any wastewater infrastructure. The drip lines at maturity of ornamental trees with root zones at maturity of less than 18 inches in depth, grasses, woody or herbaceous shrubs, and street furniture may be located within a minimum horizontal separation of 7.5 feet from any wastewater infrastructure.

c. The need for relocating, replacing or protecting in place existing wastewater infrastructure beneath these features and their amenities shall be determined on a case-by-case basis by AW.

2. Installation of Circular Intersections or Other Geometric Street Features in new areas of development with no existing wastewater infrastructure.

a. Proposed wastewater infrastructure may be placed beneath proposed circular intersections or other geometric street features such as, but not limited to, modern roundabouts, medians, bulb-outs, splitter islands, channelization islands, and other types of physical roadway features. These features may contain hardscaping, landscaping, water quality features, public art, permanent structures, street furniture, or other similar amenities.

b. The planning and design of these features and their amenities shall include consideration for access, maintenance, protection, testing, cleaning, and operations of utility infrastructures. Trees with root zones of 18 inches in depth or greater at maturity may be considered for inclusion provided the drip lines at maturity of the proposed trees are not located within a minimum horizontal separation of 7.5 feet from any wastewater infrastructure. Public art, permanent structures, and other similar amenities may be considered for inclusion provided they are not located within a minimum horizontal separation of 7.5 feet from any wastewater infrastructure. The drip lines at maturity of ornamental trees with root zones at maturity of less than 18 inches in depth, grasses, woody or herbaceous shrubs, and street furniture may be located within a minimum horizontal separation of 7.5 feet from any wastewater infrastructure.

c. The need for alternative alignments or the inclusion of protective systems for the proposed wastewater infrastructure beneath these features and their amenities shall be determined on a case-by-case basis by AW.

J. Lift Stations (Excluding low pressure systems).

Lift stations are discouraged and will be allowed only where conventional gravity service is not feasible (Lift Station installation cost plus 30 years O&M expense is less than installation cost for gravity system). This subsection details the specific design criteria for wastewater lift stations proposed for immediate or future City operation and maintenance within the City of Austin or its ETJ. Additional requirements for individual lift stations may be imposed by the Director of AW or his designee as conditions warrant.

In addition to these criteria, all lift stations must meet TCEQ rules and AW Submersible Wastewater Lift Station General Specifications.

1. Flow Development.

Calculation of wastewater flow shall be done in accordance with Section 2.9.4.A. The following calculations shall be included:

a. Maximum Wet Weather Flow (Design Flow).

This flow is used to determine the lift station design capacity. All lift stations shall be designed to handle the maximum wet weather flow for its service area.

Equation:

(Population of service area × 70 gallons per capita per day (gpcd) × maximum flow peaking factor) + (750 gallons per acre served).

b. Maximum Dry Weather Flow.

This flow is used to determine pipe size in the collection system.

Equation:

(Population of service area) × (70 gpcd) × (maximum flow peaking factor)

c. Average Dry Weather Flow.

This is the flow developed without the maximum flow peaking factor. This flow is used to determine the average detention time in the wet well.

Equation:

(Population of service area) × (70 gpcd)

d. Minimum Dry Weather Flow.

This is used to determine the maximum detention time in the wet well.

Equation:

(Population of service area) × (70 gpcd) × (minimum flow peaking factor)

e. A minimum of 2 pumps shall be required for all lift station. The capacity of the pumps shall be such that the maximum wet weather flow can be handled with the largest pump out of service.

2. Wet Well Design.

a. The bottom of the wet well shall have a minimum slope to the intake of 2 vertical to 1 horizontal with a smooth concrete surface, or 1 vertical to 1 horizontal with a slick coated surface per SPL WW-511. There shall be no projections in the wet well, which would allow deposition of solids.

b. The wet well volume shall be sized to provide adequate storage volume at peak design flows and a pump cycle time of sufficient duration to prevent pump short cycling and consequential motor damage. Pump cycle time, defined as the sum of "pump off" time plus "pump on" time, shall be as follows:

Motor H.P.	θ Min (Minimum Cycle Time in Minutes)
2 to 50	10
51 to 75	15
76 to 250	30
251 to 1,500	45

Volume between "pump on" and "pump off" elevation (of the pump cycle) shall be determined by the following criteria:

$$V = \frac{\theta q}{4}$$

Where: q = pump capacity in gpm and θ is the minimum cycle time in minutes

c. All "pump on" levels shall have a minimum separation of 1 foot between levels. All "pump off" levels shall be at least 6 inches above the top of the pump casing. For more than 2 pumps, the "pump off" levels shall be staged with a minimum separation of 1 foot between levels.

d. An example of a ~~2 pump~~ ***2-pump*** staging sequence follows:

High-level alarm

Lag pump on

Lead pump on

Lag pump off

Lead pump off

Low-level alarm

The high level alarm shall be at least 1 foot above the last (highest) "pump on" level in the wet well and also at least 1 foot below the flow line of the lowest influent line into the wet well.

e. For lift stations with 3 pumps or more, the following method for calculating the wet well volume may be used:

$$V = \frac{\theta \times q_1}{4}$$

and $K = (q_1 - q_2) + q_1$

$V2 = V' \times N \times V_1$

Where:

V_1 = working volume for the first pump in gallons

θ = minimum cycle time in minutes

Q_1 = capacity of the first pump in gpm

Q_2 = capacity of the second pump in gpm

K = the ratio of the discharge increment to the discharge of the first pump, dimensionless

V_2 = working volume for the second pump gallons

V' = the ratio of additional draw down volume to the volume for one pump, dimensionless

N = number of pumps

1) Calculate V1 and K;

2) Locate K on Table 1 and read the corresponding value for V');

3) then calculate V2.

f. An example of a ~~3 pump~~ ***3-pump*** starting sequence is as follows:

High-level alarm

Third pump on

Second pump on

First pump on

Third pump off

Second pump off

First pump off

Low Level alarm

For the location of the ~~high level~~ ***high-level*** alarm, refer to the example of a two-pump starting sequence.

TABLE 1: V′ values Corresponding to various K Values

K	V′	K	V′	K	V′
0.00	0.00	2.10	1.36	3.49	2.63
0.33	0.00	2.13	1.39	3.53	2.67
0.44	0.01	2.17	1.42	3.57	2.70
0.53	0.04	2.20	1.45	3.61	2.74
0.62	0.08	2.23	1.49	3.65	2.77
0.70	0.12	2.27	1.52	3.69	2.81
0.77	0.16	2.30	1.55	3.73	2.85
0.84	0.21	2.34	1.58	3.77	2.88
0.90	0.25	2.37	1.62	3.81	2.92
0.96	0.29	2.41	1.65	3.85	2.96
1.02	0.34	2.45	1.68	3.89	3.00
1.07	0.38	2.48	1.71	3.93	3.03
1.12	0.42	2.52	1.75	3.97	3.07
1.17	0.46	2.55	1.78	4.01	3.11
1.22	0.51	2.59	1.81	4.05	3.15
1.26	0.55	2.62	1.84	4.09	3.18
1.30	0.59	2.66	1.88	4.13	3.22
1.34	0.63	2.70	1.91	4.17	3.26
1.38	0.66	2.73	1.94	4.21	3.30
1.42	0.70	2.77	1.97	4.25	3.34
1.46	0.74	2.81	2.01	4.29	3.38
1.50	0.78	2.84	2.04	4.33	3.42
1.54	0.81	2.88	2.07	4.38	3.45
1.57	0.85	2.92	2.11	4.42	3.49
1.61	0.89	2.95	2.14	4.46	3.53
1.65	0.92	2.99	2.18	4.50	3.57
1.68	0.96	3.03	2.21	4.54	3.61
1.72	0.99	3.07	2.24	4.58	3.65
1.75	1.03	3.10	2.28	4.63	3.69
1.79	1.06	3.14	2.31	4.67	3.73
1.82	1.09	3.18	2.35	4.71	3.77
1.86	1.13	3.22	2.38	4.75	3.81
1.89	1.16	3.26	2.42	4.79	3.85
1.92	1.19	3.29	2.45	4.84	3.89
1.96	1.23	3.33	2.49	4.88	3.93
1.99	1.26	3.37	2.52	4.92	3.97

2.03	1.29	3.41	2.56	4.96	4.01
2.06	1.33	3.45	2.59	5.01	4.05

K = Pump discharge (Dimensionless) V' = Volume (Dimensionless) Source: ALBERT PINCINE

3. Wet Well Detention Time.

   a. Calculate the detention time (Td) in the wet well for the maximum wet weather flow, maximum dry weather flow and average dry weather flow using the following equation:

   $T_d = t_f + t_e$

   Where:

   $T_f = (v) \div (i)$ = time to fill the wet well in minutes

   $T_e = (v) \div (q - i)$ = time to empty the wet well in minutes

   v = Volume of wet well between "pump on" and "pump off" elevations in gallons

   q = Pump capacity in gpm

   i = flow into the station corresponding to the maximum wet weather flow, maximum dry weather flow or average dry weather flow in gpm.

   b. Maximum detention time shall be calculated with i = minimum dry weather flow.

   c. Odor control shall be provided for the wet well if the total detention time in the wet well and force main system exceeds 180 minutes.

4. Static Head.

   The static head shall be calculated for "pump on" and "pump off" elevations in the wet well.

5. Net Positive Suction Head.

   The net positive suction head (NPSH) required by the pump selected shall be compared with the NPSH available in the system at the eye of the impeller. The engineer shall consult the pump manufacturer for the NPSH required values for that pump and compare them with calculated values for the NPSH available. The NPSH available should be greater than the NPSH required for a flooded suction pump. The following equation may be used for calculating the NPSH available:

   $NPSH_A = P_B + H_s - P_v - Hf_s$

   Where:

   P_B = barometric pressure in feet absolute,

   H_s = minimum static suction head in feet,

   P_v = vapor pressure of liquid in feet absolute,

   Hf_s = friction loss in suction in feet.

   For lift stations in Austin's service area a barometric pressure of 33.4 feet may be used and a vapor pressure of 1.4 feet may be used. These values are based on the following assumptions: An altitude of 500 feet above sea level, a water temperature of 85ºF and a specific gravity of water of 0.996 at 85ºF.

6. Suction Piping Design.

   a. All suction piping shall be flanged ductile iron and have a minimum diameter of 4 inches. Each pump shall have a separate suction pipe.

   b. Suction piping shall have a velocity of 3 to 5 fps.

   c. All suction pipes inside the wet well shall be equipped with a flare type, down-turned intake. The distance between the bottom of the flare and the floor of the wet well shall be between D/3 and D/2 where D is the diameter of the flare inlet.

7. Force Main Design.

   a. All force main pipe and fittings outside the lift station site shall be polyethylene (PE) except where PE components of the required size, pressure class, or configuration are not available. In those cases, alternative materials will be considered, subject to AW approval. Flexible fittings shall be provided at the exit wall.

   b. Force mains shall be a minimum of 4 inches in diameter and sized so that the flow velocity is between 3 and 6 feet per second at initial and ultimate development. Initially, the force main shall be sized so the flow velocity is at least 3 feet per second and less than 4 feet per second for the most efficient operations. Velocities above 4 feet per second will be reviewed/approved on a ~~case by case~~ ***case-by-case*** basis. The pump size may need to be increased above the minimum size pump in order to meet the minimum flow rate in the force main. During initial development phases for lift stations with 3 or more pumps, flow velocities may be as low as 2.5 feet per second with one pump running.

   c. The maximum time required to flush the force main shall be calculated on the basis of average dry weather flow. Flush time shall be calculated for average dry weather flow using the following equations:

$$T_{flush} = (t_f + t_e) \times \frac{\text{(Force Main Length)}}{(\theta/2)\ (V_{fm})\ (60\ \text{sec/min})}$$

Where:

*See Section 2.9.4.J.3.a, "Wet Well Detention Time", for an explanation of v and q.

   d. Odor and corrosion control shall be provided for the force main if the force main detention time exceeds 30 minutes if dual force mains are not feasible.

   e. Location and size of all ***combination*** air ~~release~~ valves shall be evaluated for odor or nuisance potential to adjacent property by the design engineer.

   ~~The use of air release valves shall be restricted to installations where there are not possible alternatives.~~

   f. Sulfide Generation Potential.

   Lift station/force main systems shall be evaluated for their sulfide generation potential and their ability to achieve scouring velocities during average dry weather flow periods. If the evaluation indicates that sulfide concentration of greater than two (2) ppm and solids deposition are likely, the design shall:

1) Define a workable sulfide control technique that will minimize sulfide formation in the force main,

2) Include "pig" launching stations and recovery points to allow cleaning of the force main, and

3) Protect the gravity main and manholes downstream of the force main from corrosion. The length of pipe to be protected shall be determined on a case-by-case basis.

g. The force main shall discharge into ~~it's~~ *its* own distinct polymer manhole. (i.e. multiple force mains shall not discharge into a single manhole.)

h. Thrust restraint when required shall be shown on the plan view.

i. All PE-pipe-to-PE-pipe and PE-pipe-to-PE-fitting connections shall be fused.

j. Polyethylene MJ adaptors shall be used to join PE pipe to valves and ductile iron fittings. PE flange adaptors may be used only on a case-by-case basis and with pre-approval by AW.

k. Anchors to control thermal thrust forces and Poisson Effects forces shall be specified at locations where PE force mains discharge into manholes, gravity wastewater pipes or under any similar circumstances where excessive movement of gasketed joints at or beyond the end of the fused PE pipe could occur. The anchors shall be designed using accepted engineering practice and assuming a Poisson's Ratio of 0.35, the thermal coefficient of expansion of PE is 1×10^{-4} in/in/°F, the apparent elastic modulus is 55,000 psi, and the temperature change is 40°F. The anchor shall be located on the PE pipe as close as possible to the end of the fused pipe.

l. Where force mains transition from polyethylene (PE) pipe to a different pipe material (ductile iron pipe, PVC pipe, etc.), the PE pipe segments shall be designed to undergo hydrostatic testing separately from the segments of different pipe material by way of isolation valves or other means.

8. Head Loss Curves.

a. Data points for the system capacity curve shall be provided in tabular form and graphed with pump head capacity curve on the same graph. Two system capacity curves shall be plotted using the Hazen Williams coefficient values of C = 100 and C = 140.

b. Pump output in gpm at maximum and minimum head shall be clearly shown on the system curve for each pump and combination of pumps.

c. For stations with two (2) or more pumps operating in parallel, multiple and single operation points shall be plotted on the system curve.

d. Pumps with the highest efficiencies at all operating points shall be used.

e. If pumps are equipped with smaller impellers during start up to handle lower than design flows, impellers sized to handle the design flow shall also be provided.

9. Buoyancy Calculations.

The lift station design shall include a complete analysis of buoyant forces on the entire lift station structure.

10. Water Hammer.

a. Calculations for water hammer showing maximum pressures, which would occur upon total power failure while pumping, shall be provided using the following equations.

$$p = \frac{(a)(V)}{(2.31)(g)} + \text{operating pressure of pipe (psi)}$$

$$a = 12 \div \left\{ \frac{w}{g} \left[\frac{1}{k} + \frac{d}{Et} \right] \right\}^{0.5}$$

Where:

p = water hammer pressure (psi)

a = pressure wave velocity (ft/s)

w = specific weight of water (62.4 lb/ft^3)

g = acceleration of gravity (32.2 ft/s^2)

k = bulk modulus of water (300,000 psi)

d = inside diameter of pipe (in)

E = Young's modulus of pipe (psi)

t = pipe wall thickness (in)

v = flow velocity in pipe (ft/s)

Surge control measures shall be provided when pressures, including those due to water hammer, exceed the pressure rating of the pipe.

11. Suction Specific Speed.

Suction specific speed of the pumps shall be calculated using the following formula:

$SSS = \Omega(Q)^{.5}/(H)^{.75}$

Where:

SSS = suction specific speed (rpm)

Q = flow at the best efficiency point, gallons per minute (gpm)

H = net positive suction head required at maximum impeller speed (feet)

Ω = speed of pump and motor in rpm

Suction specific speed should be below 9,000 rpm to ensure that the pump will not cavitate because of internal recirculation.

12. Stiffness Ratio.

In order to ensure that the pump shaft does not bend an excessive amount, the engineer shall calculate the stiffness ratio of the shaft using the following equation:

Stiffness Ratio = L^3 / D^4

where:

L = distance from impeller centerline to the centerline of the inboard bearing (inches)

D = diameter of shaft (inches)

The stiffness ratio shall not exceed 60.

13. Energy Calculations.

For lift stations with flows exceeding 75 gpm but less than 1,000 gpm, and if the engineer is considering a submersible type lift station as an option then the engineer shall submit cost comparisons for submersible stations versus wet well/dry well stations. These cost comparisons should include the initial station costs, installation costs and power costs for the life of the station.

Energy costs for each type station shall be calculated using the following equations:

a. Calculate the water horsepower required.

$$P = \frac{(Q)(h)(8.34 \text{ lb/gal})}{33{,}000 \text{ ft-lb min/hp}}$$

where:

P = water horsepower (hp)

Q = flow, gallons per minute (gpm)

h = head, feet (ft)

b. Calculate the brake horsepower required.

$$Bhp = \frac{P}{\text{pump efficiency*}}$$

where: Bhp = brake horsepower (hp)
P = water horsepower (hp)

* Use the most efficient pumps for the application.

c. Calculate the electrical horsepower required.

$$Ehp = \frac{Bhp}{\text{motor efficiency}}$$

where: Ehp = electrical horsepower (hp)
Bhp = brake horsepower (hp)

Use the most efficient motors for the application.

d. Calculate the power required in kilowatts.

EkW=(Ehp)(0.746 Kw/hp)

e. Calculate daily power consumption in kilowatt-hours.

$E = [(EKW_1)(t_1) + (EKW_2)(t_2) + (E\,KW_3)(t_3)...]$

where: E = total power consumption, kilowatt hours (kWh) per day
EkW^n = power required, kilowatts for pumps 1,2,...,n
t^n = estimated pump run time in hours per day for pumps 1,2,...,n

f. Calculate the estimated cost for power consumption over the life of the station.

C = (E)($0.06/kWh)(T)

where:

C = cost of power over the life of the station (dollars)

E = power consumption (kilowatt-hour per day - kWh/day)

T = time the station is expected to be in service (days)

g. Stress and thrust calculations for internal station piping and bends shall be provided for stations with flows over 1,000 gpm.

14. Sump Design.

The following items apply for lift station dry well sump pumps:

a. Dual submersible sump pumps, each with a minimum capacity of 1,000 gallons per hour (gph), shall be provided.

b. The design head of the sump pumps should be the static head from the sump to one foot above the hundred-year flood level plus allowances for pipe friction both inside and outside the pump chamber.

c. Sump piping shall be galvanized steel with a minimum diameter of two (2) inches.

d. Sump discharge from the dry well shall be installed through the wall of the wet well at a point not less than 12 inches above the top of the influent pipe and grouted in place with a ~~water tight~~ ***watertight*** seal.

e. The dry well floor shall slope toward the sump pit.

15. Specific Station Requirements.

a. All stations will be required to have an equipment-lifting device.

b. Engineering calculations are required showing that temperatures inside the dry well do not exceed 85°F, while the pumps are operating.

c. Stations with motors greater than 100 hp shall use a horizontal pump/motor configuration.

d. Stations with motors 75 hp and larger shall have reduced voltage starters of the auto transformer or solid-state soft start type. Part winding starters and motors are not acceptable. Motors larger than 75 hp shall be designed with a maximum temperature rise not to exceed 80°C over a 40°C ambient temperature. Motors larger than 300 hp may require a higher temperature rise and may be specifically approved with such.

e. Motors 75 hp and smaller shall be provided with high efficiency frames. Maximum temperature rise shall not exceed 90°C over a 40°C ambient temperature.

f. Stations deeper than 30 feet, measured from the finished floor to the top of the entrance tube, shall require an electrically powered personnel lift.

g. Entrance hatches larger than 40 inches in diameter shall be spring loaded.

h. Valves higher than six (6) feet above the floor shall have chain operators.

i. Any potable water supply below the overflow elevation of the wet well shall be protected by an air gap.

j. All lift stations must have a back-up power source. Looped service from two (2) different substations is adequate backup power. If a back-up electric system is not feasible, a diesel generator may be located on the lift station site instead. Generator shall be equipped with noise and air pollution control devices.

k. Flow monitoring will be provided for all lift stations.

16. All-weather access roadway.

a. General.

1) An access road shall be designed and constructed within an established access easement that connects a lift station facility to a paved public roadway.

2) Roadways shall have a concrete or asphalt concrete pavement as the roadway's surface.

b. Design.

1) Roadway shall have a longitudinal slope not to exceed 15%, a minimum transverse slope of 2%, no vertical grade break greater than 12%, no vertical curve greater than 1% per horizontal foot, a centerline radius of no less than 50 feet, a minimum width of 12 feet.

2) Road base material and sub-base material as recommended by Geotechnical Report for the site specific soil and load conditions.

3) Roadway shall include a means for equipment to turn around.

4) Culverts, where required, shall be minimum of 12 inches in diameter. Culvert lengths shall reach to the toe of the fill without changing the side slope of the fill.

c. Easements.

1) Easements for access roadways shall be a minimum of 25 feet wide with the roadway centered on the easement. Narrower easements will be considered where the Engineer provides evidence, to the satisfaction of AW, that maintenance activities will not be hindered by the reduced width.

2) Easement documents and the metes and bounds shall be reviewed and approved by AW UDS - Pipeline Engineering prior to recordation in the real property records of the appropriate county. Easement recordation in the real

property records of the appropriate county is required prior to AW approval of construction plans.

17. Wastewater Lift Station Specifications.

In addition to the design criteria presented in this document, AW has "Wastewater Lift Station General Specifications and Drawings". These documents delineate minimum City requirements as they relate to the construction and installation of wastewater lift stations. Copies of these documents are available and can be obtained from AW.

18. Alternate Wastewater Systems.

a. General.

Low-pressure wastewater systems are discouraged and will be allowed only where conventional gravity service is not possible. For the purpose of these criteria, low-pressure sewer service is defined as private grinder pump facilities or private septic tank effluent pump facilities that do not convert to gravity flow at or prior to the property line. There shall be no more than one grinder pump facility per single family or duplex residential lot. Each grinder pump shall discharge to a gravity flow system. Grinder pump facilities for commercial establishments, Public Utility Districts (PUD), Municipal Utility Districts (MUD), Water Control and Improvement Districts (WCID) or condominiums will be considered on a case-by-case basis.

The distance for each grinder pump from the property line to the gravity main shall not exceed 200 feet.

Flows may be calculated using the Lift Station Design Criteria disregarding the Infiltration/Inflow flow component.

If the above criteria are applicable and a low-pressure wastewater service is necessary, AW will be responsible for maintaining the portion within the right-of-way only.

Design and installation of the property owner's pumping system, as well as all associated plumbing shall be reviewed, approved and inspected by the City of Austin. The system shall be designed as a complete system including all connections, pumps, etc. for lots being served by the system. If the above criteria are not applicable, refer to Lift Station design criteria.

b. Connection to Gravity Main.

Each grinder pump facility shall be individually tied into a manhole on the existing gravity sewer or an existing force main. If a manhole does not exist, one shall be constructed. Construction costs and all other associated costs shall be the responsibility of the property owner.

The connection to the gravity main shall be designed to minimize turbulence and the release of hydrogen sulfide. The discharge point shall be at or below the springline of the gravity main.

c. Cleanout and Valve Assemblies.

A cleanout and corrosion resistant eccentric plug valve shall be placed just inside of the right-of-way where City maintenance begins and private maintenance ends. This cleanout will allow the property owner's system to be isolated and the City's portion of the system to be pressurized, flushed or rodded.

Cleanouts and corrosion resistant eccentric plug valves shall also be installed at bends of 45 degrees and greater. All fittings, valves and bends shall be at least two (2) inches in diameter and all bends, tees, and wyes with a change of direction of 45 degrees or greater shall be made up of sweeping or long radius components. Force Mains shall not include any pipe with a diameter smaller than 1&half inches.

Refer to applicable standard Detail(s) in the City of Austin Standards Manual.

d. Separation Requirements.

The separation between low-pressure sewer lines and waterlines shall comply with City of Austin Standard Specifications and all other applicable rules and regulations.

e. Grinder Pump System General Specifications and Drawings.

In addition to the design criteria presented in this document, AW maintains "Grinder Pump System General Specifications and Drawings." These documents delineate minimum City requirements as they relate to the construction and installation of grinder pump systems. Copies of these documents are available and can be obtained from AW.

Source: Rule No. R161-17.08 , 5-31-2017; Rule No. R161-17.16 , 8-23-2017; Rule No. R161-18.02 , 3-2-2018; Rule No. R161-18.04 , 6-1-2018; Rule No. R161-18.14 , 9-14-2018; Rule No. R161-19.18 , 11-13-2019; Rule No. R161-20.11 , 8-14-2020; Rule No. R161-22.03 , 2-14-2022; Rule No. R161-22.09 , 8-8-2022.