RULE NO.: R161-17.16

NOTICE OF RULE ADOPTION **ADOPTION DATE: August 23, 2017**

By: Greg Meszaros, Director
Austin Water

AUG 23 2017 AM 9:03

The Director of the Department of Austin Water has adopted the following rule. Notice of the proposed rule was posted on July 6, 2017. Public comment on the proposed rule was solicited in the July 6, 2017 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 available for public inspection and copying at the following locations. Copies may be purchased at the locations at a cost of ten cents per page:

> Austin Water, located at 3907 S. Industrial Dr., Ste. 236, Austin, Texas. See Mr. Eric Langhout, P.E.; and
>
> Office of the City Clerk, City Hall, located at 301 West 2nd Street, Austin, Texas.

EFFECTIVE DATE OF ADOPTED RULE

A rule adopted by this notice is effective on August 23, 2017.

TEXT OF ADOPTED RULE

The adopted rule contains no changes from the proposed rule.

R161-17.15: Proposed revision to the Utility Criteria Manual Section 2.9.4

UCM Section 2.9.4

- All Sections – Throughout this section, we are changing "AWU" to "AW", "Peak Dry Weather Flow" to "PDWF", and any other acronyms that are incorrect.
- Section 2.9.4.B.3, 4, & 5 – Add changes to these sections to allow the Engineer to be allowed to design a wastewater main at less than 2 feet per second without going through the waiver request process.
- Section 2.9.4.C.8 – It was brought to my attention that "25-8-361" should be changed to "25-8-261".
- Section 2.9.4.D.3.b – This language was added to insure if our manholes are being adjusted up or down in elevation, the current ring and cover size is

utilized which currently is 32 inches. This has recently come up on TXDOT projects.

- Section 2.9.4.D.7.Note 3 – We added “and cast-in-place bases” to this section to allow the Engineers to place the holes for new pipes into cast-in-place bases of manholes at a minimum separation distance of 7” instead of 12”.
- Section 2.9.4.G.2-3 – This was added to prevent retail connection request to high pressure force mains.
- Section 2.9.4.J – We decided to remove the Chapter sections from TCEQ since they can change in the future that will result in incorrect referencing. We will just reference TCEQ.
- Section 2.9.4.J.7.b – This information was added to clarify the section.
- Section 2.9.4.J.16 – This information was added to require Engineers to provide an “All-weather access roadway” in easements to lift stations for City maintenance purposes. It describes what is required for this roadway.

The adopted rule contains no changes from the proposed rule. A copy of the complete text of the adopted rule is available for public inspection and copying at the following locations. Copies may be purchased at the locations at a cost of ten cents per page:

Austin Water, located at 3907 S. Industrial Dr., Ste. 236, Austin, Texas. See Mr. Eric Langhout, P.E.; and

Office of the City Clerk, City Hall, located at 301 West 2nd Street, Austin, Texas.

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 regulate the installation of water and wastewater facilities is established in the Texas Local Government Code Section 552.001 and Title 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 R161-17.16, 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

______________________________ Date: 8/16/17

Greg Meszaros, Director
Austin Water

______________________________ Date: 8/18/17

Anne L. Morgan
City Attorney

Austin Water 3rd Quarter 2017 Backup Material

For Proposed Changes to UCM Sect. 2.9.4

2.9.4 - Wastewater Systems

A. Determination of Wastewater Flow

1. Residential single-family units shall be assumed to produce an average wastewater flow of 245 gallons/day.

2. Industrial wastewater flows will be evaluated on a case-by-case basis.

3. Inflow/Infiltration.

   In sizing sewers, external contributions are accounted for by including 750 gallons per day per acre served for inflow and infiltration. For sewers in the Edwards Aquifer Zone refer to the Texas Commission on Environmental Quality (TCEQ) requirements. Strict attention shall be given to minimizing inflow and infiltration.

4. Peak Dry Weather Flow ***(PDWF)***.

   The ~~peak dry weather flow~~ ***PDWF*** is derived from the formula:

   $$Qpd = [(18+(0.0206 \times F)^{0.5})/(4+(0.0206 \times F)^{0.5})] \times F$$

   where: F = 70 gal./person/day × population/1440
   = average dry-weather flow in gpm

5. Peak Wet Weather Flow ***(PWWF)***.

   The ~~peak wet weather flow~~ ***PWWF*** is obtained by adding inflow and infiltration to the peak dry weather flow. In designing for an existing facility, flow measurement shall be used in lieu of calculations for the preexisting developed area.

B. Determination of Pipe Size

1. Minimum Size.

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

2. Design Requirements.

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

   a. The main shall be designed such that the ~~Peak Dry Weather Flow~~ ***PDWF*** shall not exceed 65% of the capacity of the pipe flowing full.

   b. The main shall be designed such that the ~~Peak Wet Weather Flow~~ ***PWWF*** shall not exceed 85% of the capacity of the pipe flowing full.

   c. For sewer mains, eighteen (18) inches in diameter or larger, the main shall be designed such that the ~~peak Wet Weather Flow~~ ***PWWF*** shall not exceed 80% of the capacity of the pipe flowing full.

3. ***Minimum*** Design Velocities.

   The minimum design velocity calculated using the ~~Peak Dry Weather Flow~~ ***PDWF*** ~~shall not be less than~~ ***must be at least*** two (2) feet per second (fps). ***If a minimum velocity of two***

(2) fps cannot be achieved due to the low projected wastewater flows, velocities lower than two (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 two (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 ~~Peak Wet Weather Flow~~***PWWF*** should not exceed ten (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.

~~4.~~***5.*** Minimum Slope.

The minimum allowable slope for eight (8) inches 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***.

~~5.~~***6.*** Allowable pipe sizes.

The following sizes will be the only sizes allowed for use in the gravity system: 6″ (for services only), 8″, 12″, 15″, 18″, 21″, 24″, 30″, 36″, 42″. Larger sizes may be approved on a 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 City of Austin 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 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 ~~Austin Water~~***AW*** and the appropriate county authority.

4. Separation Distance.

The separation between wastewater mains and other utilities shall be in accordance with the Rules adopted by ~~the Texas Commission on Environmental Quality~~***TCEQ***.

5. 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 twenty-five (25) feet (preferably at joint locations).

6. Depth of Cover.

If fill or embankment placed over existing wastewater mains exceeds four (4) feet or the cut exceeds the minimum depth of cover, 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.

7. Turbulence.

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

8. Wastewater lines are prohibited in a critical water quality zone, except for a necessary crossing. (see the Code of the City of Austin, 25-8-~~3~~***2***61).

9. 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. Construction of all-weather access roads may be necessary for manhole and/or wastewater line access. 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 fifteen (15) dwelling units and for commercial developments containing more than 4,000 square feet of air condition***ed*** space and requiring a water meter greater than 2", 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 Chapter 15-10 (Wastewater Regulations) of the Austin 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 replacement and removal 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~~U~~ 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 ***fifteen (***15***)*** inches diameter. External drops will be limited to a depth of fifteen (15) feet from the lid of the manhole to the base. Drop manholes in excess of fifteen (15) feet deep must be designed with an internal drop and must be a minimum size of five (5) foot diameter.

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

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

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.

Note 3: New pipe connections to existing manholes shall provide a minimum of 12″ 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 cast-in-place bases*** shall have holes for pipe penetrations separated by a minimum of seven (7) inches 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 six (6) feet, when the depth of the main is sufficient.

8. Where a separation of nine feet between a water main and a 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 nine (9) feet between a water main and a manhole cannot be achieved during construction of a new water main, then the manhole shall be assessed as per Section 2.9.4.D.4 to determine if the manhole is watertight and if not, shall require the manhole to 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 using a flexible system applied to the exterior surface. The drawings shall indicate which structures must be water proofed 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 using water stops.

E. Ventilation

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

F. Inverted Siphons

The use of siphons is discouraged. When no feasible option exists, the following criteria apply. Siphons shall have a minimum of two barrels. The minimum pipe size shall be six (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 mains(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 service lines, between the main and property line, shall have an inside diameter not less than six (6) inches. The minimum grade allowed for service lines is one (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. ~~No service connections shall be made to mains larger than 15 inches in diameter.~~

~~1~~*2*. ***No service connections shall be made to mains larger than 15 inches in diameter.***

3. ***Service connections to force mains that are 2 inches in diameter and smaller may be allowed on a case by case basis. Service connections to force mains that are larger than 2 inches in diameter shall not be allowed.***

~~2~~*4*. Usually wastewater services are placed along the common property line between two lots where there is no conflict with other utilities' services. All other Utility service is usually located at the other lot corner. Wastewater service should be placed four (4) feet on the low (or right, if on a level ground) side of the lot, nine (9) feet from the water service (located on the other side of the lot line). Services to lots without a water/wastewater easement will terminate at the property line with a cleanout; service to lots having a five (5) foot by five (5) foot water/wastewater easement will terminate within the easement. For details, see the City of Austin Standard Details.

~~3~~*5*. Wastewater clean-outs are not allowed in sidewalks or driveways.

~~4~~*6*. 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. Easements

1. Easements for wastewater mains shall be a minimum of 15 feet wide, or twice the depth of the main, measured from finished grade to pipe flowline, whichever is greater. Mains 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.

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.

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 ~~the Austin Water Utility~~***AW*** or his designee as conditions warrant.

In addition to these criteria, all lift stations must meet ~~the Texas Commission on Environmental Quality~~***TCEQ*** ~~Chapter 317.3~~ rules and ~~the Austin Water~~***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 x 70 gallons per capita per day (gpcd) x 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) x (70 gpcd) x (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) x (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 two (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 two (2) vertical to one (1) horizontal. 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 1500	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 one (1) foot between levels. All "pump off" levels shall be at least six (6) inches above the top of the pump casing. For more than two (2) pumps, the "pump off" levels shall be staged with a minimum separation of one (1) foot between levels.

d. An example of a two (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 one foot above the last (highest) "pump on" level in the wet well and also at least one (1) foot below the flow line of the lowest influent line into the wet well.

e. For lift stations with three 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 three (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 alarm, refer to the example of a two pump starting sequence.

~~TABLE 1: V′ values Corresponding to various K Values~~ ***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) ÷ (i) = time to fill the wet well in minutes

      T_e = (v) ~~+~~÷ (q - i) = time to empty the wet well in minutes

      v~~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 one and four-tenths (1.4) feet may be used. These value 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 four (4) inches. Each pump shall have a separate suction pipe.

   b. Suction piping shall have a velocity of three (3) to five (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 mains shall be ductile iron with non-corrosive lining or an approved HDPE with a minimum diameter of four (4) inches. Force main pipe within the station shall be flanged. Flexible fittings shall be provided at the exit wall.

   b. Force mains shall be sized so that the flow velocity is between three (3.0) and six (6.0) feet per second at ***initial and*** ultimate development. During initial development phases ***for lift stations with 3 or more pumps***, flow velocities may be as low as two and one-half (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:

$t\cancel{T}_e$ = Time to empty wet well in minutes

$t\cancel{T}_f$ = Time to fill wet well in minutes

V_{fm} = Flow velocity in the force main in feet per second

θ = Pump cycle time in minutes

$^*t_e = \cancel{V}v / (q - i)$

$^*t_f =$ ~~;frac;V~~ v / i

i = average dry weather flow in gpm.

*See Section 2.9.4.J.3.a, "Wet Well Detention Time", for an explanation of $v\cancel{V}$ 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 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 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 own distinct 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.

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 1000 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 1000 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 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 a 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~~6~~. Wastewater Lift Station Specifications

In addition to the design criteria presented in this document, ~~the Austin Water~~***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 ~~the Austin Water~~***AW***.

1***8***~~7~~. 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, ~~the Austin Water~~***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 1-1/2 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, ~~the Austin Water~~***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 ~~Austin Water~~***AW***.