

## **CHAPTER 7 – SEWER SYSTEM DESIGN STANDARDS**

### **7.1 GENERAL INFORMATION AND REQUIREMENTS**

This section of the City of Surprise Engineering Development Standards explains the required standards to be followed when designing a sanitary sewer system project within the City of Surprise (city). Refer to Chapter 10 for additional information regarding inspection procedures.

1. These guidelines and standards apply to the City of Surprise sewer service area only. A map defining this service area is available online on the city's website at [www.surpriseaz.gov](http://www.surpriseaz.gov).
2. All developments, including single-family residences, are required to connect to the city's sewerage system. Individual and on-site disposal/septic systems are not allowed within the city's annexed boundaries. Exceptions are made only with the prior written approval of the Water Resource Management Director or designee.
3. A Wastewater Master Plan shall be submitted for all commercial and residential developments and industrial projects that are to connect to the city's sanitary sewer system. The master plan shall identify the demand that the new development or project will impose on the system, provide a model of the proposed sewer system, and a resulting report, analyze the feasibility of the city's sanitary sewer system ability to service the new development, and identify any improvements necessary to maintain the sanitary sewer system's service standards. The master plan shall be submitted at the beginning of the development review process. See the City of Surprise Wastewater Master Plan Preparation Guide on the Engineering Development Services page on the city's website at <http://www.surpriseaz.gov>.
4. All developments shall provide for all categories of sewer lines required to provide sewer service for both the individual development and the ultimate build-out area according to the city's Integrated Water Master Plan (IWMP).
5. Public wastewater lift stations are discouraged and are allowed only under unusual circumstances with the prior written approval of the Water Resource Management Director or designee, following the Engineering Standards Modification Request Procedures described in Chapter 1, Section 1.5. When a lift station is the only means by which a property may be serviced, the developer is responsible for building the lift station, bonding the operation and maintenance of the lift station for a period of 20 years, and for replacing the lift station after that initial 20-year period.

### **7.2 TYPES OF SANITARY SEWER LINES**

The City of Surprise sewerage system consists of the following five types of sanitary sewer lines as determined by use.

1. Building Sewer – Conveys sewage from a single building to a lateral sewer or the building connection.
2. Lateral Sewer – Also referred to as the building connection in the SUDC Chapter 58. Collects sewage from building sewers at the property line and conveys it to the sewer tap of a branch or main sewer.
3. Branch Sewer – Collects sewage from lateral sewers and conveys it to a main or trunk sewer. Receives sewage from more than one public sewer from a relatively small area.
4. Main Sewer – Collects sewage from two or more branch sewers as tributaries.

5. Trunk Sewer – Conveys sewage from many tributary main or branch sewers over large areas to water reclamation facilities. Also known as interceptors.

### 7.3 MATERIALS OF SANITARY SEWER LINES

Standard sewer pipe materials have been specified within the City of Surprise for all sewer lines. Sewer lines shall consist of polyvinyl chloride (PVC) solid wall plastic sewer pipe and shall conform to the requirements of ASTM D-3034, SDR-35 or C900. Other materials can be used only with the authorization by the Water Resource Management Director or designee. When requesting alternative material, the applicant shall provide proof that the proposed material is equivalent or superior in performance to PVC. This includes but is not limited to providing material specifications (or cut sheets) and ASTM information for city approval. All sewer lines shall comply with MAG standard specifications Section 745, except as modified below:

1. Private on-site sewer lines shall be constructed of materials and at slopes defined in the International Plumbing Code as adopted by the City of Surprise.

### 7.4 DESIGN CRITERIA OF SEWER LINES

1. All sewer lines within the city shall be designed according to the standards set forth in ADEQ Bulletin 11, City of Surprise IWMP, A.R.S. R18-9-E301.4.01.D.2, and MAG Standard Specifications and Details.
2. Under gravity flow conditions, the system will be designed with a velocity between two feet per second when flowing full and nine feet per second. Under pressurized conditions, the system will be designed with a velocity between three and eight feet per second. This criteria is identified in the city's IWMP.
3. The minimum allowable sewer line size in a public street is eight inches in diameter; however, a six inch diameter sewer line is permitted for the first 400 feet of a dead-end sewer line with no potential for extension if all other design criteria are satisfied.
4. All sewers will be designed to give mean velocities, when flowing full, of not less than two (2) feet per second. All velocity and flow calculations will be based on the Manning Formula using an "N" value of 0.013. The slopes will be the minimum for the size indicated. Exceptions to these minimum slopes will be made at the upper end of lateral sewers serving less than thirty (30) houses. Said sewers will have a minimum slope of 0.76 percent. Where lateral sewers serve less than ten (10) houses, the minimum slope will not be less than one (1) percent. The following table lists minimum slopes for various sewer sizes:

**Table 7-1 – Minimum Slopes by Sewer Diameter**

Sewer Diam. (inches)	Minimum Slope (%)	Sewer Diam. (inches)	Minimum Slope (%)
8	0.33	18	0.11
10	0.24	21	0.092
12	0.19	24	0.077
15	0.14		

5. Curved sewers shall have a minimum 500-foot radius. Only eight-inch and larger mains shall be curved with prior written approval of the Water Resource Management Director or designee.

## **7.5 LOCATIONS OF SEWER LINES**

1. All rights-of-way shall be dedicated to the city prior to commencing construction. The locations of sanitary sewer lines within rights-of-way will depend on the classification of the road, and the lines shall be located according to the guidelines shown in the City of Surprise Standard Details 3-01 through 3-07.
2. All sewers shall be parallel to property lines or centerlines, or as close to parallel as possible.
3. The minimum horizontal clearance between a sewer line and another underground utility shall be six feet measured from the outside of each pipe.
4. Prior to the acceptance of any construction, all exclusive sanitary sewer utility easements must be dedicated to the city. The minimum width for a single sanitary sewer line easement is 20 feet. Each additional line requires an additional 10 feet of easement. Sanitary sewer lines shall be centered within the easement unless prior written approval to locate the sewer line elsewhere has been provided by the Water Resource Management Director or designee.
5. Sewer lines shall not be placed beneath retention/detention basins.

## **7.6 DEPTH AND SEPARATION OF SEWER LINES**

1. The minimum depth of cover shall be six feet for all sewer main and trunk lines. In the City of Surprise sewer service area, this depth shall be measured from top of pipe to top of finished grade.
2. Where the cover is less than six feet (due to topography such as canals, washes, etc.), a six-inch thick, one-sack concrete cap shall be constructed in place over the sewer line. This cap shall extend not less than two feet to either side of the barrel of the pipe and shall extend at least five feet beyond the limits of the canal, wash, etc.
3. Wastewater, potable, and reclaimed line separation and protection shall be in accordance with MAG Standard Details 404-1, 404-2, and 404-3, Sections 610.5, 615.3, and 616.3 of the MAG Standard Specifications and City of Surprise Standard Details 3-01 through 3-07.

## **7.7 PIPE BEDDING AND MARKER BALL REQUIREMENTS**

1. The pipe bedding and backfill for sewer line construction shall conform to MAG Specifications 601 and 615, except as modified below.
  - a. All sewer lines installed within the City of Surprise shall be bedded from the bottom of the excavation to one foot above the pipe with 100% ABC material, as outlined in MAG Specification 702. The initial bedding under the pipe is required for all pipes with a diameter of eight inches or larger and in all cases where rocks larger than 1½ inches in diameter are encountered along the trench bottom.
2. Marker balls shall be green and installed at all sewer line fittings and every 100 feet if the distance between fittings is greater than 100 feet.
3. All lines shall be marked with marking tape located one foot above the top of the pipe. Marking tape for wastewater lines shall be green and labeled "Caution: Sanitary Sewer Line" or approved equal.
4. All marker balls and marking tape shall be installed per City of Surprise Standard Detail 7-03.

## 7.8 SEWER SERVICE TAPS

1. For all projects requiring only a sewer tap, an application form is required for permit. The application form is located in Appendix 7-1.
2. All tie-ins to the active sanitary sewer system shall be made only after the completion of the new work and specific approval has been received from the Water Resource Management Director or designee.
3. The minimum tap sizes shall be set based on the land use being served by the lateral as shown in Table 7-2.

**Table 7–2 Minimum Sewer Tap Sizes**

<b>Tap Function</b>	<b>Tap Size (inches)</b>
Residential Lot	4
Commercial Lot	6
Multi Family Lot	6

4. All sanitary sewer taps within the city shall be performed per MAG Standard Details 440 and 441.
5. All taps shall be made at a 45 degree angle in the direction of the flow and enter the top or side of the pipe.
6. The minimum separation between sewer service taps shall be three feet.
7. The preferred sewer tap location is center of lot.
8. Taps eight inches or larger in diameter or those to a sewer line 12 inches or larger in diameter must be installed directly to a manhole.
9. A backflow prevention valve shall be installed on a service tap if the lowest finished floor elevation is below the upstream manhole rim elevation.
10. Metallic detector tape shall be installed on each individual sewer tap per City of Surprise Standard Detail 7-03. Marking tape shall be green and labeled: "CAUTION: SANITARY SEWER LINE". Marker balls shall be placed directly above all lateral stub ends and taps.
11. All sewer taps into manholes shall be dimensioned from the property line.
12. In cases where driveways may conflict with normal placements of water and/or sewer services, developers may propose alternative locations. However, in no case will water services be closer than 3 feet or sewer services closer than 6 feet to property lines.

## 7.9 SEWER MANHOLES AND CLEANOUTS

The City of Surprise has established the following requirements for the materials, type, and spacing for both manholes and cleanouts within the sewer system.

### 7.9.1 Materials of Manholes

All manholes within the City of Surprise shall be per MAG Standard Specifications Section 625 except as modified below.

1. All manholes shall be constructed of either cast-in-place concrete or pre-cast concrete.
2. No steps shall be permitted in City of Surprise manholes.
3. All manholes installed within the city outside of paved areas shall be identified by a Carsonite continuous glass fiber and resin-reinforced green CUM-375 Composite Marker installed ten feet offset from the manhole centerline, but not outside of the dedicated right-of-way or easement limits. The installation of the marker in an alternate location requires prior written approval from the Water Resource Management Director or designee.

### 7.9.2 Spacing of Manholes and Cleanouts

1. Table 7-3 below outlines the maximum allowed spacing between manholes.

**Table 7–3 Maximum Manhole Spacing**

Pipe Size (diameter in inches)	Maximum Spacing (feet)
8 to 12	400
15 to 24	500
>24	600

2. A cleanout may be installed in the place of manholes at the end of lines no more than 100 feet from the last manhole. Cleanouts are not permitted on sewer pipes eight inches in diameter and larger.

### 7.9.3 Manhole Locations

In addition to the spacing defined under section 7.9.2, manholes are required at the following locations:

1. All changes in grade or slope.
2. All changes in pipe size.
3. All changes in alignment.
4. All pipe intersections other than service connections less than eight inches in diameter.
5. All service connections eight inches in diameter and larger.
6. Manholes shall not be located in washes or retention/detention basins

### 7.9.4 Manhole Design Criteria

1. The sizing of manholes is based on the diameter of the sewer line connected to the manhole. Table 7-4 below presents minimum manhole diameters.

**Table 7–4 Minimum Manhole Diameters**

<b>Pipe Size (diameter)</b>	<b>Manhole Diameter (inches)</b>	<b>Manhole Cover Size (inches)</b>
8 to 12	48	24
≥ 15	60	30

2. If the sewer line is deeper than 10 feet below land surface, a 60-inch manhole diameter is required.
3. Service inverts shall be a maximum of 12" above the outlet main crown elevation.
4. Each manhole shall have no more than 4 entrances including the inlet and outlet connections and 2 service connections.
5. Manholes constructed on the boundaries of subdivisions or improvement districts shall include full-line size stubs with shaped inverts. These stubs shall be installed in the direction appropriate for future connections.
6. Manholes containing a through sanitary sewer line creating a change in direction greater than 30 degrees shall have a minimum drop of 0.20 feet across the manhole. A through line with a change in direction less than 30 degrees shall have a minimum drop of 0.10 feet across the manhole. The lines shall intersect at an angle of no more than 90 degrees.
7. If the sewer lines contained in the manhole are not the same diameter, then the crown of the upstream pipe shall always be higher than the crown of the downstream pipe.
8. Lateral sewer connections to a branch sewer may have a maximum drop of 12 inches from flow line to flow line without a drop connection.

**7.10 WASTE CONTROL FROM COMMERCIAL DEVELOPMENTS AND MULTI-FAMILY RESIDENTIAL**

1. Grease, oil, lint, or sand interceptors shall be required for laundries, restaurants, service stations, auto repair shops, car washes, and other facilities when the city determines that they are necessary for the proper handling of liquid wastes containing grease, oil, any flammable wastes, sand, or other harmful ingredients in excessive amounts.
2. All interceptors shall be of a type and capacity approved by the city and shall be 24-hour accessible for cleaning and inspection.
3. Grease and oil interceptors shall be constructed of impervious materials capable of withstanding abrupt and extreme changes in temperature. They shall be of substantial construction, watertight, and equipped with easily removable covers. When bolted covers are required, they shall be gastight and watertight.
4. Where installed, grease, oil, and sand interceptors shall be maintained in continuously efficient operation by, and at the expense of, the owner at all times and records for the past 12 months shall be kept on-site for the city's review. Maintenance shall be performed at a minimum of every 90 days or as determined by the City.
5. Hair traps are required for grooming facilities.
6. Interceptors are required in the following commercial facilities, but not necessarily limited to, as required by the SUDC and the Water Resource Management Director

or designee. Interceptor sizing and capacity shall be per calculations by an Engineer registered in the State of Arizona. The minimum size of an interceptor for restaurants shall be at least 750 gallons (2,500 gallons max).

**Table 7-5**

Restaurants	All types, Fast food chains, Pizza delivery, Sandwich shops, Bakeries
Service Stations	Auto repair, Car washes, Fuel stations
Hair trap required business	Pet Grooming, Salons, Laundries
Other	Any other facility deemed necessary for potential discharge by the City of Surprise Environmental Manager.

7. All photo processing facilities, dental offices, and x-ray processing facilities shall be equipped with a metals recovery unit.

**7.11 WASTE CONTROL FROM INDUSTRIAL DEVELOPMENTS**

All industrial facilities shall complete an Industrial Pretreatment Preliminary Survey. After review of the Preliminary Survey, the Water Resource Management Department may require the further completion of a Pretreatment Permit Application & Industrial/Commercial User Survey. Both documents can be obtained from the Environmental Division of the Water Resource Management Department or [www.surpriseaz.gov](http://www.surpriseaz.gov).

**7.11.1 Preliminary Treatment Facilities**

1. Where necessary and as determined by the city, any user of the sewer system shall provide, at their expense, such preliminary treatment as may be necessary to reduce objectionable characteristics or constituents to within the maximum limits provided in the SUDC Chapter 58.
2. Plans, specifications, and any other pertinent information relating to proposed preliminary treatment facilities shall be submitted for the approval of the Water Resource Management Director or designee.
3. The approval of the plans and inspection of construction shall not relieve the owner from complying with the discharge limitations set forth in the Surprise City Code. The city shall enforce Federal pre-treatment requirements as set forth in the Code of Federal Regulations.

**7.11.2 Control Vault / Monitoring Manhole Requirements**

1. All industrial facilities shall install an industrial waste control vault/monitoring manhole to facilitate the observation, measurement, and sampling of the process waste from that facility. Such a control vault/monitoring manhole, when required, shall be 24-hour accessible and constructed in accordance with plans approved by the city. The control vault/monitoring manhole shall be installed and maintained by the owner at his/her expense. The sampling vault shall be installed on the owner's property close enough to the public right-of-way to allow 24-hour access by city personnel and within the limits of the manufacturer's requirements. After the installation is complete, the owner shall provide the city's Water Resource

Management Department with the keys necessary to access the vault. See City of Surprise Standard Detail 7-02.

2. All concrete used to construct the vault's floor, walls, and top slab shall conform to MAG Standards Specifications, Class A, and its minimum compressive strength at 28 days shall be 3,000 psi.
3. All concrete used for the vault's grout fillet inside the structure shall conform to MAG Standard Specifications, Class C, and its minimum compressive strength at 28 days shall be 2,000 psi.
4. All steel reinforcement in vaults shall be in the form of deformed bars, Grade 60, billet steel conforming to A.S.T.M. Specification A-615.
5. Flume size shall be based upon minimum and maximum flow rates and velocities to ensure free-flow conditions. Maximum flow shall not exceed 100% of the maximum capacity of the selected flume size. A minimum flow depth of 0.5 inches should exist during the minimum actual flow.
6. The flume floor elevation shall be high enough, relative to the downstream conditions, to prevent submergent flow (50% submergence is acceptable at maximum flow). The flume shall be installed level with the floor both longitudinally and transversely in the converging section.
7. Upstream flow should be wave-free, non-turbulent, symmetrical, and uniform in velocity (one fps minimum to three fps maximum) for a length of at least ten times the flume throat length in the approach channel. Bends in the outlet or inlet pipe will not be permitted for a distance of 25 pipe diameters upstream and downstream.
8. It shall be the owner's responsibility to properly maintain the flume in accordance with the manufacturer's recommendations to ensure the accuracy of the flow measurement.
9. Monitoring manholes shall be constructed according to MAG Standard Detail 420, for "48" Diameter Pre-Cast Concrete Sewer Manhole."
10. A sanitary sewer manhole cover shall be used for monitoring manholes. See City of Surprise Standard Detail 7-01.
11. Excluding the monitoring manhole, all manhole sections shall be sealed with both "ramneck" mortar and cement mortar.
12. Manholes shall be constructed per MAG Specification 625.

### **7.11.3 Industries Required to Install Control Vaults in the Building Sewer**

Industries included in, but not necessarily limited to, Table 7-6 below shall install a control vault in the building sewer.

**Table 7–6 Industries Required to Install Control Vault in the Building Sewer**

Adhesives manufacturing	Food Processing	Paint formulating
Aluminum forming	Foundries (metal molding and casting)	Pesticide chemical manufacturing
Any Industry Requiring Pre-Treatment	Glass manufacturing	Petroleum refining
Asbestos manufacturing	Grain mills	Pharmaceutical manufacturing
Battery manufacturing	Hospital	Porcelain enameling
Carbon black manufacturing	Ink formulation	Printing and publishing
Coil coating	Inorganic chemical manufacturing	Pulp, paper, and paperboard manufacturing
Copper forming	Iron and steel manufacturing	Rubber manufacturing
Dye Manufacturing or Processing	Laboratories	Soap and detergent manufacturing
Electrical and electronic components manufacturing	Laundries	Steam electric power generation
Electroplating	Leather tanning and finishing	Sugar processing
Feedlots	Mechanical product manufacturing	Tars and asphalt paving and roof material manufacturing
Ferroalloy manufacturing	Metal finishing	Textile mills
Fertilizer manufacturing	Nonferrous metal manufacturing	Timber product processing

**7.12 SEWER LINE CONSTRUCTION**

All construction of wastewater lines within the city shall comply with applicable MAG Standards Section 615, City of Surprise Standard Specifications, and ADEQ Engineering Bulletin No. 11.

**7.13 SEWER LINE INSPECTION**

All newly installed branch, main, and trunk sewers in the right-of-way or an easement shall be inspected by closed circuit television methods acceptable to the city. Any defects discovered during televised inspection shall be corrected at no cost to the city. After the correction of defects has been completed, affected sewer sections shall be re-televised at no cost to the city. DVDs of all televised inspections shall be provided to the city prior to final acceptance of the sewers.

**APPENDIX 7-1**

**SEWER TAP PLAN  
PERMIT APPLICATION**



**PUBLIC WORKS DEPARTMENT**  
 Engineering Services  
 16000 N Civic Center Plaza  
 Surprise, Arizona 85374  
 Office: (623) 222-6150  
 Fax: (623) 222-1701  
 Web Site: [www.surpriseaz.gov](http://www.surpriseaz.gov)

**CITY OF SURPRISE SEWER TAP PLAN – PERMIT APPLICATION**

Property Information			
Owner's Name:		Date:	
Site Address:		Zip Code:	
Phone:		APN #:	

**Site/Construction Plan:**

Boxes to be completed by applicant. Contact City of Surprise (COS) Public Works Department for utility and right of way information.

Water Line

(Distance from C/L)

(Distance from C/L)

(Size and Material Type)

Sawcut and remove existing pavement minimum 4' wide. AC replacement per COS approved mix design. Consult inspector for appropriate mix designs. AC replacement to match existing depth of asphalt.

C/L

(Size and Material Type)

(Right-of-Way Width)

6' minimum spacing between services

Sewer Line

Install 4" sewer tap per MAG 440-1 with marker ball located at wye and at property line. Bedding and backfill per MAG Detail 200-1

Water Service

M

(Lot Length)

(Distance between sewer tap and property line)

(Lot Width)

Curb and gutter shall be replaced per MAG Detail 220. Sidewalk shall be replaced per MAG Detail 230.

**THIS SECTION TO BE COMPLETED BY THE CITY**

**Permit Quantities:**

Sewer Base Fee	_____	EA
Trench (0'-5', 5'-10')	_____	LF
Wet Taps	_____	EA
Paving Base Fee	_____	EA
Pavement	_____	SY
Concrete Base Fee	_____	EA
Curb and Gutter	_____	LF
Sidewalk	_____	SF

Approval: \_\_\_\_\_ Date \_\_\_\_\_  
 City of Surprise Engineer

Submit 2 copies of this application to Engineering Services