



GRAVITY SEWER

CHAPTER 4

SECTION I

ENGINEERING DESIGN STANDARDS

The City of *Buckeye* Arizona
Engineering Design Standards
Adopted July 7, 2020

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Section 4-1 – Gravity Sewer

This section provides policy and standards establishing design criteria for constructing and modifying wastewater systems to be dedicated and conveyed to the City of Buckeye (City) pursuant to, and in accordance with City Code. Upon City acceptance of the wastewater infrastructure, dedication, and conveyance to the City, the City will own, operate, and maintain such infrastructure. This section provides guidance on design report preparation, wastewater collection systems, and final plan preparation.

The requirements of this section may be modified at any time by the City Engineer.

The City Engineer may approve variances to the requirements of this design standard. Variance requests must be submitted in writing and include a justification for the variance requested. A copy of the City approved variance shall be included with the submittal of any plans or design reports that incorporate the variance.

The City Engineer is required, pursuant to Chapter 23, Article 23-2, of the City Code, to develop standards and details regarding public improvements to be constructed within the City. The standards, design criteria, and policy set forth in this section were developed and recommended by the City Engineer pursuant to Chapter 23, Article 23-2 and adopted by City Council in Resolution No. 57-12.

4-1 Gravity Sewer

4-1.000 General Information:

4-1.001 **Wastewater Infrastructure Requirements:**

- A. This section is to aid the engineer in developing a sewer infrastructure design to meet the City of Buckeye minimum standards.
- B. Developers/Landowners are required, pursuant to the City Code, including the City Development Code, to install, at their expense, all on-site and off-site improvements necessary to provide wastewater service to their development. This includes any sanitary sewer lines, lift stations, force mains, or other facilities and the payment of all required development fees.
- C. This section applies to City Capital Improvement Projects.
- D. Required to pull all necessary permits.

4-1.002 **Acronyms, Definitions, and Abbreviations:**

- A. AAC - Arizona Administrative Code
- B. ABC – Aggregate Base Course
- C. ACC – Arizona Corporation Commission
- D. ADEQ - Arizona Department of Environmental Quality
- E. ADHS - Arizona Department of Health Services
- F. ANSI - American National Standards Institute
- G. APN - Assessor's Parcel Number
- H. A.R.S. - Arizona Revised Statutes
- I. ASTM - American Society for Testing and Materials
- J. ATC – Approval to Construct
- K. AWWA - American Water Works Association
- L. CC&R – Conditions, Covenants, and Restrictions
- M. City – City of Buckeye
- N. City Engineer – City of Buckeye Engineer or designee
- O. CLSM – Controlled Low Strength Material
- P. CMP - Community Master Plan
- Q. COB – City of Buckeye
- R. Cover – The distance between the top outside of pipe and grade elevations at the location of measurement (typically a rim elevation on a manhole or cleanout).
- S. d/D – Depth of flow divided by the inside diameter of the pipe
- T. Developer – Shall mean the individual or entity causing Development of land in the City, including Development companies authorized to act on behalf of the Developer. The Developer shall also mean a contractor (“Contractor”) authorized to act on behalf of the Landowner or Developer.

Developers shall also be interpreted to mean Landowners.

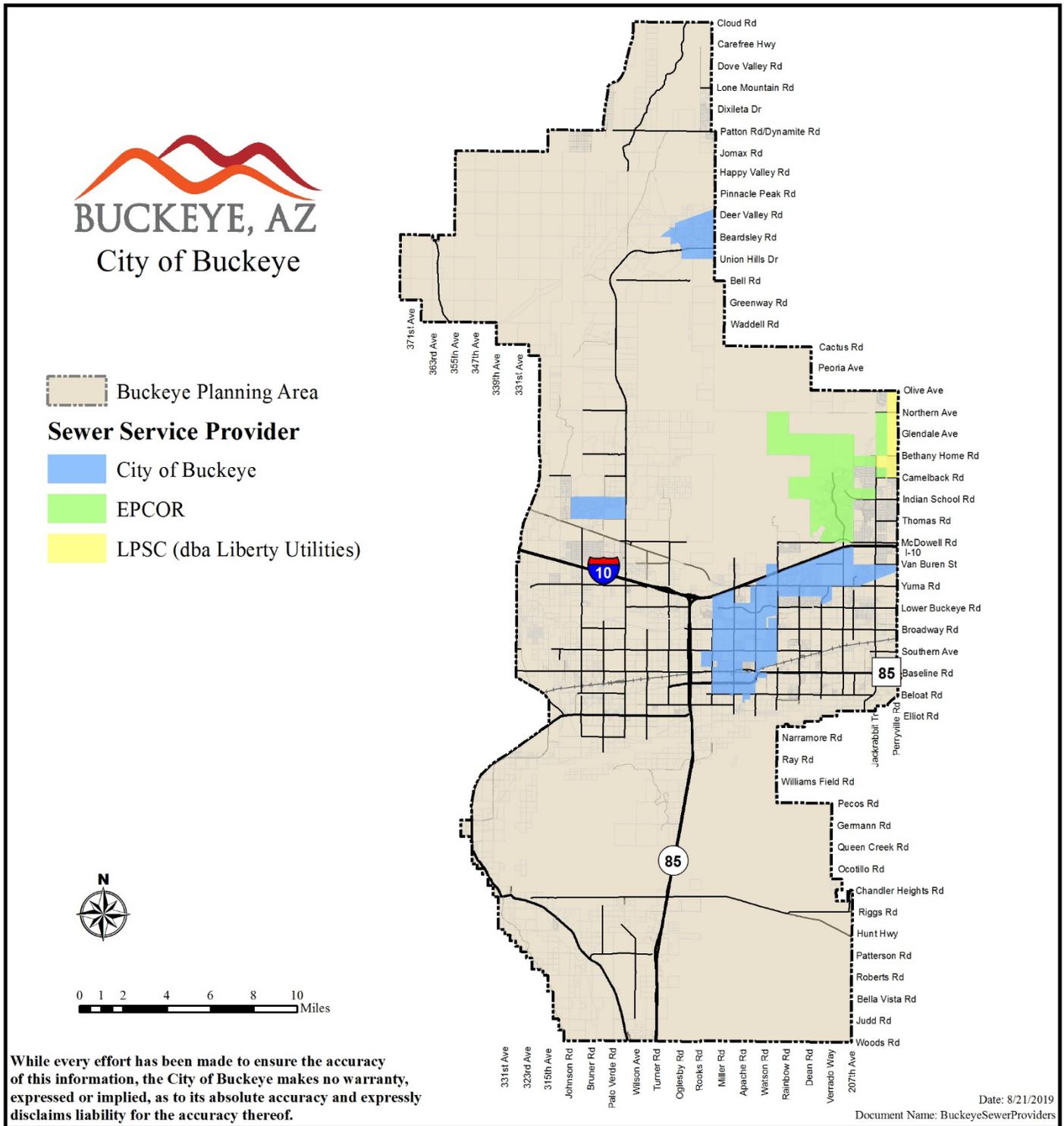
- U. Development or development – Any activity that changes the use of land or makes a material change to the appearance of a structure or property. Also, the following constitute development: Clearing of land as an adjunct of construction, including clearing or removal of vegetation or soil manipulation; Deposit of refuse, solid, or liquid waste or fill on a parcel of land; Placement of a sign; Changes or alteration of a watercourse, drainage way, or another waterway; or Paving, filling, grading, or covering of land.
- V. DU – Dwelling Unit
- W. EDU – Equivalent Dwelling Unit
- X. Engineer – An engineer registered professionally in the State of Arizona pursuant to the provisions of A.R.S. §32-101; §§32-121-131; §§32-141-152, as amended.
- Y. EPA - Environmental Protection Agency
- Z. FCDMC – Flood Control District of Maricopa County
- AA. fps – feet per second
- BB. GPCD - gallons per capita per day
- CC. GPD - gallons per day
- DD. GPM - gallons per minute
- EE. GPAD – gallons per acre per day
- FF. GPSFD – gallons per square foot per day
- GG. GPSD – gallons per student per day
- HH. Horizontal Separation – The dimension measured horizontally between the outside of one item to the outside of an adjacent item.
- II. ID – Inner Diameter
- JJ. Landowner - Shall mean the owner of the land in the City on which Development occurs. “Landowner” shall also be interpreted to mean Contractor and/or Developer, including Development companies authorized to act on behalf of the Developer/Landowner.
- KK. LPPUE – Limited Purpose Public Utility Easement
- LL. MAG - Maricopa Association of Governments Uniform Standard Specifications and Details for Public Works Construction current edition
- MM. MH - Manhole
- NN. MCESD - Maricopa County Environmental Services Department
- OO. Plan(s) - Design drawings that are 100 percent complete and sealed by a registered professional Engineer.
- PP. POTW - Publicly Owned Treatment Work
- QQ. PUE - Public Utility Easement
- RR. PVC - Polyvinyl Chloride
- SS. Public Works Inspector - A City employee or contracted consultant with a primary responsibility of monitoring the construction of improvements for conformance to City requirements.

- TT. ROW – Public Rights-of-Way
- UU. TCO – Testing Cleanout
- VV. WRF - Wastewater Reclamation Facility
- WW. Vertical Separation – The dimension measured vertically between the outside of one item to the outside of another.
- XX. VCP – Extra Strength Vitrified Clay Pipe

4-1.003 Design Policy:

- A. Developers/Landowners shall comply with the City’s requirements for extension of wastewater systems to newly developed areas and subdivisions inside the City’s service area. See [Figure 1](#).
- B. Sanitary sewers are required along the entire length of all property line frontages with and without access, where future expansion of the wastewater system is possible. The property line frontage is that portion of the property that abuts a street or public ROW.
- C. The engineer shall analyze the wastewater generation from a proposed development and determine its impact on the City’s wastewater collection system. The engineer shall certify an analysis that extends from the development to a point on the downstream system in compliance with a master plan previously accepted by the City. The effects of peak wastewater rates shall be evaluated to ensure proper sizing of proposed wastewater collection facilities.
- D. City approval of plans and associated design reports are valid for one year from the date of City Engineer’s signature.
- E. If a construction permit for the plans has not been issued within one year from the date of approval noted on the cover sheet, the plans have not changed, and are deemed by the City to be in substantial conformance with this manual or its subsequent revisions, a re-approval from the City Engineer will be required; however, a comprehensive review may not be necessary. If there are revisions to be made to bring the plan set into conformance with this manual, a comprehensive review (including payment of fees) will be necessary.
- F. Engineering Bulletin No. 11, “Minimum Requirements for Design, Submission of Plans and Specifications of Sewage Works” published by the Arizona Department of Environmental Quality as well as the Arizona Administrative Code, “Title 18 - Environmental Quality,” contain specific requirements for submittals, approvals and notifications when extension of a public sanitary sewer line is proposed. The developer/landowner and the engineer designing the plans shall comply with all laws, regulations, and requirements.
- G. All Developers/Landowners desiring or required to connect to the City of Buckeye sewer system are required to be annexed within the City’s corporate limits.
- H. All construction documents shall be prepared by a registered Professional Civil Engineer licensed and practicing in the State of Arizona pursuant to the provisions of A.R.S. §32-101; §§32- 121-131; §§32-141-152. Each sheet of the plans shall include the appropriate professional State of Arizona seal, signature, date and date of expiration below seal. The City of Buckeye does not require original seals and or signatures (wet seal) on improvement documents during the review cycle.
- I. All final plans that include connection to or extension of the City’s sanitary sewer system, or on a system that is to be dedicated to the City, must be submitted to the City of Buckeye for review and approval. Plan review fees must be paid at the time of plan submittal.

Figure 1 City of Buckeye Sewer Service Area



4-1.004 Diligence:

- A. Developers/Landowners shall verify the need for any wastewater extensions necessary to provide service to a site or to provide onsite facilities. It is the Developer's responsibility to become familiar with all of the existing site conditions. Available resources in which to find this information
 1. Records - Obtain existing utility maps and As-Built drawings
 2. City's website – <http://www.buckeyeaz.gov>.
 3. The City Engineer can confirm the need for any required extension or conditions for wastewater service.
- B. All entities seeking sewer service from the City need to be familiar with City Code, including Chapter 16 of the City Code.
- C. Any apparent field condition, error, omission, etc. shall be brought to the attention of the City Engineer.

4-1.005 MAG Reference:

- A. The engineer should be familiar with the *MAG Uniform Standard Specifications for Public Works Construction*, including all applicable Standard Details. These documents contain construction related specifications and details that impact the design of wastewater systems including trenching, bedding, backfill, and pavement replacement, etc.

4-1.006 Standards:

- A. The following is a list of national, regional, and local resources (the latest editions unless otherwise stated), which are referenced and used for the design within the City of Buckeye.
 1. Resources, Standards, and References:
 - a. ADEQ Engineering Bulletin No. 11
 - b. *MAG Uniform Standard Specifications for Public Works Construction*

4-1.007 Implementation:

- A. The implementation and enforcement of the design standards set forth in this section shall be effective the date of City Council's adoption of the resolution approving the standards and requirements of this section and shall apply to the following:
 1. All new plans and reports submitted to the City following the effective date of City Council's adoption of the resolution approving the standards and requirements of this section.
 2. All plans and reports seeking a new City Engineers signature or a re-approval from the City Engineer.
 3. All expired plans and reports shall be brought into conformance with the design standards.
 4. All plans and reports produced under an approved CMP shall follow or be brought into conformance with the design standards.
 5. All expired or abandoned plans and reports shall be per the adopted Development User Fee Schedule.

4-1.008 Intent to Serve:

- A. As part of the City's approval process and in accordance with the A.A.C., developers/landowners shall obtain a sewage treatment capacity letter from the City stating the City's wastewater system

will be adequate to handle the development's flow and quality.

4-1.009 EPA Regulations:

- A. The EPA requires the City to develop and implement a program to control discharges that might harm the POTW. The program establishes local discharge limits for non-residential users and provides a permitting process based on the users' discharges and types of businesses. The City's Water Resources Department is the City Department authorized by City Council to enforce provisions of Chapter 16 of the City Code. Contact the Water Resources Department at (623) 349-6800 for details and requirements of such Chapter.

4-1.010 ADEQ Requirements:

- A. Policy:
 1. MCESD is required to review and approve all public sanitary sewer line extensions and construction of wastewater related facilities within the City's service area, prior to the City approving the final plans. Before the City may approve final plans, the developer/landowner shall submit a cover sheet for the improvement plans with a completed signature and date of approval from MCESD.
 2. Prior to commencing construction, the contractor or developer/landowner shall provide a copy of the MCESD approved Certificate of Approval to Construct and/or Provisional Verification of General Permit Conformance.
 3. Before the sewer system is accepted or put into service and prior to any issuance of a Certificate of Occupancy, the Developer/Landowner shall submit a Certificate of Approval of Construction and/or Verification of General Permit Conformance signed by MCESD.

4-1.011 Private Wastewater Companies:

- A. Existing Private Wastewater Companies:
 1. Portions of the City's municipal service area are provided by private wastewater companies. See [Figure 1](#) City of Buckeye Sewer Service Area, which delineates these areas. Placing private sanitary sewer lines within City ROW will require a written agreement between the private wastewater company and the City. The private company shall review modifications or construction of wastewater systems within their franchise areas. Current private wastewater providers are:
 - a. EPCOR (previously Arizona American Water Company)
 - b. LPSC (Litchfield Park Service Company) dba Liberty Utilities
- B. Responsibility of Private Wastewater Companies:
 1. Developer/Landowner shall obtain approval of the applicable private wastewater company for the construction of and modification to wastewater systems within the franchise areas. Prior to obtaining City approval of the design documents, the Developer/Landowner shall submit to the City written documentation that the private wastewater company has approved facilities shown on the final plans. The private wastewater company approval of the design plans shall be evidenced by the written signature or stamp of the authorized individual from the company on the plans.
 2. A letter from the private wastewater company approving the As-Builts shall be provided to the City. This letter will serve as the official record of the As-Built approval.
 3. Private wastewater company shall issue an approval of the As-Builts in order to allow paving to commence.

C. City Review of Private Wastewater System Extensions:

1. The City cannot provide wastewater service within private wastewater company franchise areas. However, plans for private wastewater system extensions shall be submitted to the City for review and approval. The review is not for comprehensive enforcement of the private utility requirements. City review is restricted to public health, safety, and welfare issues for work that is to occur within the City's ROW. A note will be placed on the final plans stating that the operation and maintenance of franchise lines are not the responsibility of the City.
2. All private sewer mains shall be located within the ROW and within the standard locations for sewer mains in the paved portion of the street. Private sewer mains shall not be located within a PUE or LPPUE as this easement is restricted for dry utilities only.
3. All private sewer mains located adjacent to a City ROW but not constructed under the current or ultimate paving section shall be required to have a private exclusive easement for the sewer main outside of the LPPUE and ROW.
4. An LPPUE shall be shown on the final plat that is for dry utilities use only.

4-1.012 Waste, Erosion, Sediment Control Plan:

- A. If the proposed construction will be larger than one acre, including linear construction, an ADEQ storm water permit is required. Proposed construction is defined as disturbed area. The Waste, Erosion, Sediment Control Plan and Best Management Practices are required by state law and shall be submitted to the City for review during the plan review process. The Waste, Erosion, Sediment Control Plan shall also be maintained at the construction site for reference during construction in accordance with the most current Arizona storm water construction general permit requirements. The ADEQ storm water permit is required in order to submit an application for and receive a City of Buckeye construction permit.

4-1.100 Wastewater Reports:

The purpose of the wastewater report is to describe the layout and design of the proposed wastewater collection system that will be owned, operated, and maintained by the City following City acceptance, dedication, and conveyance of the improvements and real property to the City. The description shall include the criteria and all assumptions used, the layout and sizing of the system, and provide all calculations and resources used. The proposed system shall meet the requirements of the City.

4-1.101 General Report Requirements

- A. All reports shall be sealed and signed on the cover and Table of Contents by a registered Professional Civil Engineer in the State of Arizona.
- B. Information from a previous report or other reports that is important to the design of the proposed project shall be included in the submitted report unless the report is a supplement to a Master Report.
- C. Reports should be letter size, bound with a hard cover.
- D. Maps and exhibits should be folded in sleeves with a maximum size of 24 inches by 36 inches and must be legible.
- E. Provide the project title on every page of the wastewater reports.
- F. All redline reports shall be returned with the submittal of the next report for review.
- G. Cover Sheet:
 1. Project title

2. Submittal date and submittal number
3. List all prior submittal dates and corresponding submittal number
4. Prepared for including: contact name, company name, address, telephone number, and email
5. Prepared by including: contact name, company name, address, telephone number, and email
6. City approval block, see [Figure 2](#)
7. Engineers seal
8. All pages of the report shall have a sequential number, except the cover.

Figure 2 City Engineer Signature / Approval Block

<p>DISCLAIMER:</p> <p>THE CITY APPROVES THIS REPORT FOR CONCEPT ONLY AND ACCEPTS NO LIABILITY FOR ERRORS OR OMISSIONS</p> <p>BY: _____</p> <p style="text-align: center;">BUCKEYE CITY ENGINEER DATE</p>

H. Table of Contents:

1. List all sections
2. Figures
3. Tables
4. Exhibits
5. Appendices

I. Executive Summary Paragraphs:

1. Criteria used
2. Criteria met
3. Project challenges
4. Overall observations
5. Conclusions
6. Recommendations

J. Introduction:

1. Provide project name, size, description, land use, and type of development.
2. Purpose of the report.
3. Describe which sewage treatment plant service area in which this project is located. Provide

general information about the plant.

4. Explain the objectives of the report, defining infrastructure requirements, satisfy regulatory requirements, and evaluate the impact of the new development on the existing systems.
5. Indicate if the proposed sewer system is public or private.

K. Project Location:

1. Township, Range, and Section
2. Description of the major cross streets
3. Vicinity Map
4. Relationship to other developments and sewer improvements.
 - a. Provide a map labeling all adjacent developments and sewer improvements.

L. Existing Conditions:

1. Describe the existing collection system infrastructure
2. Topography
 - a. General slope of the property, high and low elevations
 - b. Challenging features for on-site gravity sewer
 - c. Benchmark(s) being used
3. All adjacent land uses

M. Tributary Area:

1. Describe all tributary area up-stream of the proposed development and how it is being accommodated with the proposed design.
2. Provide a map showing offsite tributary areas and locations where sewer is being provided for those areas.

N. Criteria

1. All design criteria shall be in compliance with the standards in this section.
2. Summarize and include all design criteria used for this report, COB and other agency requirements, and criteria.

O. Design Methodology:

1. Identify land use, population, density, loadings and peaking factors.
2. All calculations shall be converted to EDUs as well as flow.
3. Summarize all flow contributions according to concentration points.
4. Summarize all offsite flow contributions per concentration points.
5. All water treatment discharge flows (waste stream) shall be included.

P. Collection System:

1. Prepare a skeletal sewer collection system map at a scale large enough to show arterial and collector roads and local streets, sewer lines, sizes, manholes, topography, two-foot contours minimum, lift stations, force mains, existing or proposed WRFs on-site, outfall to offsite

existing or proposed collection system if appropriate, and stubs or mains to offsite portions of the service area, if appropriate.

2. Demonstrate that connections to offsite service areas, if any, are deep enough to serve the entire offsite property while meeting depth-of-cover requirements.
3. Show evidence that adequate capacity has been included in the receiving downstream WRF and when capacity will be available.
4. If the proposed collection system will discharge to an existing or proposed offsite trunk sewer line or lines and flow conveyed to an offsite WRF, provide evidence that the design of the receiving trunk lines have included the necessary capacity to convey the design flow at a d/D of 75 percent maximum. If required by the City, the downstream sewer shall be analyzed to where the City feels there is sufficient capacity in the system or to the treatment plant headwork's. This could include flow monitoring and computer modeling.

Q. Modeling:

1. InfoSewer or approved equal output that can be input into the City's model shall be used for modeling of the sewer system. This allows the City to easily add the proposed development to the City's overall model.
2. Identify all assumptions made.
3. Include the following information in tabular form. The column headers listed are the minimum required in the design table.
 - a. Pipe Label
 - b. Upstream Manhole Number
 - c. Downstream Manhole Number
 - d. Upstream Invert Elevation
 - e. Upstream Rim Elevation
 - f. Upstream Pipe Cover (ft)
 - g. Downstream Invert Elevation
 - h. Downstream Rim Elevation
 - i. Downstream Pipe Cover (ft)
 - j. Pipe Length (ft)
 - k. Pipe Slope (ft/ft)
 - l. Pipe Diameter (in)
 - m. Pipe Material
 - n. Pipe Manning's n value
 - o. Contributing Flow (gpd)
 - p. Contributing EDU's / acreage
 - q. Cumulative Average Daily Flow (gpd)
 - r. Peaking Factor

- s. Total Peak Flow (gpd)
 - t. Design Pipe Capacity, Full (gpd)
 - u. d/D (Max = 0.75)
 - v. Velocity (ft/sec)
4. Provide an electronic copy of the InfoSewer model or any Excel spreadsheets from other approved modeling software with the approved report.
 5. Include a map of the collection system showing all manhole numbers, pipe segments, and pipe diameter (by color). The map shall be provided at a readable scale. Use multiple pages, if necessary.
 6. If modeling existing sewers and the analysis shows d/D is greater than 0.75, provide a map of the existing system being modeled while color-coding by severity, all pipe segments exceeding the d/D .
 7. When pipe segments exceed d/D of 0.75, manhole surcharged depths shall be added to the table. Discuss what remedies may be available to eliminate surcharged conditions.
- R. Conclusion:
1. Summarize the work that has been completed.
 2. Summarize all recommendations.
 3. List all reference documents.
 4. State that all of the COB requirements, as well as all other agencies, have been satisfied.
- S. Appendices:
1. Supporting calculations.
 2. Attach all relevant portions of external approved reports, including cover page, that validate the design assumptions of this report.
 3. All other supporting information.

4-1.102 Types of Wastewater Reports:

There are five different types of reports that can be submitted to the COB. Each type of report has a specific use. The following is a description of each of the reports as well as their use:

A. Master Wastewater Report:

1. A master wastewater report is required to accompany and support all CMP submittals to the City.
2. Master wastewater reports are intended to cover large areas addressing all tributary areas upstream of the specific concentration point or area of interest.
3. Master wastewater reports can vary in detail, but the overall requirement is to show how the entire master-planned area is being served by sewer. The report must show how gravity sewer service is physically possible, and that depth of cover requirements are satisfied.
4. The City may request a master wastewater report for any development.
5. Master wastewater reports are not signed by the City Engineer.

B. Preliminary Reports:

1. Preliminary sewer reports are required to accompany and support a preliminary plat or preliminary site plan.
 2. Preliminary reports shall comply with all general report requirements.
 3. Preliminary reports can further detail areas within a master wastewater report, multi-phased project, or a stand-alone un-phased project.
 4. Preliminary reports vary in detail. However, enough detail is required to prove how the entire preliminary plat or site plan is served by sewer and that the proposed design is physically possible.
 5. If the preliminary report is following an approved master wastewater report, describe any changes from the approved master wastewater report.
 6. Use the most current design criteria. Reference Tables 1-3 for design criteria.
 7. Modeling is not mandatory for a preliminary report but may be required by the City in the sole discretion of the City Engineer.
 8. Solutions provided should include enough design calculations to validate the proposed sewer.
 9. Preliminary plats cannot be approved prior to the approval of the preliminary sewer report. This may also apply to site plans, depending on the nature of the preliminary site plan and its location.
 10. Preliminary reports are not signed by the City Engineer.
- C. Final Reports:
1. Final reports are required to accompany and support all final plats and final design plans.
 2. Final reports shall comply with all general report requirements.
 3. Final reports shall complete the design from a preliminary report or master wastewater report.
 4. Describe all changes from the master wastewater report or preliminary report. All changes shall be incorporated into the report, models, and results.
 5. The Final Report must include criteria, assumptions, special conditions, and complete calculation tables and figures to provide a complete description of the proposed wastewater collection system as a basis of final plans and specifications.
 6. All models and tables shall be complete.
 7. Use the most current design criteria. Reference Tables 1-3 for design criteria.
 8. Final plat, site plans, and/or final plans shall not be approved until the final report is approved.
 9. Final reports are signed by the City Engineer.
- D. Private Facilities Reports:
1. Reports submitted to private wastewater companies with service areas within the City of Buckeye shall also be submitted to the City for approval.
 2. The City has authority over the location and surface facilities in public ROW and property owned or controlled by the City.
 3. Reports to private wastewater companies and the City will not be approved by the City unless first approved by the private wastewater service company.

4. Private reports must show that the private wastewater company can provide adequate capacity to support the proposed development.
 5. Private reports shall comply with all general report requirements in this section.
 6. A signature line for the private utility provider shall be provided on the front cover of the report.
 7. The executed “Will Serve” letter from the private utility company is required to be part of the report.
 8. Private facilities reports are signed by the City Engineer.
- E. Areas Served by Septic:
1. In areas where public sewer mains are not available, private septic installations may be allowed. These systems must conform to the MCESD requirements. All septic systems shall be approved by the MCESD.
 2. The COB requires that they be constructed in such a way so that in the event that public or approved private sewer becomes available, the septic system may be easily disconnected and the supplying structure connected to the approved sewer system.
 3. The developer/landowner shall submit the appropriate sewer report for the project to allow the COB to anticipate the flows from this area in the future.
 4. The projected flows will be used to size an onsite “dry sewer” for future connection to COB sewer mains when extended.
 5. The report shall state how the development meets the requirements to be able to install septic systems.
 6. Septic system reports are not signed by the City Engineer.

4-1.200 Collection System:

4-1.201 General Requirements:

- A. Multi-family and commercial developments shall install private sanitary sewers onsite.
- B. Users discharging industrial wastes shall install monitoring and flow metering structures as required by the City in addition to complying with Chapter 16 of the City Code.
- C. Design Policy:
1. Wastewater flows must be accepted by the City to be discharged into the City’s collection system.
 2. When a public sanitary sewer line is located within 660 feet of the boundary of the subject property, the developer/landowner may be required to extend the public sewer system to their property, at no cost to the City, in order to serve the development. Individual owners may be required to connect or extend the public system at no cost to the City.
 3. When approved by the COB and MCESD, a separate on-site wastewater solution may be constructed for each lot only when a public wastewater system is not available.
 4. For developments and subdivisions where an existing sanitary sewer is not available, a dry, sanitary sewer line shall be installed conforming to all the design requirements for a public sanitary sewer line.
 - a. All ends of the system, not including services, shall be terminated with a testing cleanout.

- b. The interim on-site septic system or other approved system shall be designed for ease of connection to the dry system when sanitary sewer service becomes available.
- c. When a home or business is built in a location where there are dry sewers or ahead of the City sewer system, an interim on-site septic system or other approved system may be used. The onsite piping shall be designed in such a manner that allows for easy abandonment of the temporary onsite system and easy tie into the City system. This includes but not limited to constructing the onsite sewer piping from within two feet of the onsite system and extending it to the City ROW. This will provide for easy connection to the COB sewer when it becomes active.
- 5. On-site septic systems or other approved systems shall be designed to serve the ultimate population density expected in the tributary area. The design shall be in conformance with the City Wastewater System Master Plan and shall account for future connections.
- 6. Where a wastewater collection system extension is possible upstream of a subdivision, the sanitary sewer shall be extended through or around the subdivision. Sewer in local streets with sewer connections is limited to a maximum size of 12 inches. Sewer services are not allowed on 15-inch sewer or larger.
- 7. Public sanitary sewer lines not installed within public rights-of-way will be located within a dedicated COB exclusive sewer easement granted to the City by the developer/landowner in accordance with City requirements of Table 4.
- 8. No private sewers are allowed within the public rights-of-way, public utility easements, or COB easements, except for sewer facilities owned by a private wastewater service provider and as agreed to by the City.
- 9. All sewers shall be designed such that hydraulic jumps are not formed due to the changing slopes.

4-1.202 Design Criteria:

A. Design Flows

TABLE 1 DESIGN FLOW CRITERIA

LAND USE		AVERAGE DAILY FLOW
Low-density Residential (Less than 2 dwelling units per acre)	Use 3.2 persons per dwelling unit	80 Gallons per person per day
Medium Density Residential (Less than 4.5 dwelling units per acre)	Use 3.2 persons per dwelling unit	80 Gallons per person per day
Medium High Density Residential (Less than 8 dwelling units per acre)	Use 3.2 persons per dwelling unit	80 Gallons per person per day
High Density Residential (8 or more units per acre)	Use 2.5 persons per dwelling unit	80 Gallons per person per day
Age Restricted Communities	Use 2.0 Persons per dwelling unit	80 Gallons per person per day

Unplanned Residential	Upstream of master planned areas to adequately size sewer for future flows	1,300 Gallons per acre per day
Commercial / Mixed Use		1,500 Gallons per acre per day
Industrial / Warehousing	Domestic flows only	1,000 Gallons per acre per day
Commercial Office / High Rise		100 Gallons per 1,000 square feet per day
Industrial		50 Gallons per person per day or 3,000 Gallons per acre per day
Hotel / Motel / Hospital		130 Gallons per room per day
Schools	With lunch & no shower facilities	50 Gallons per student per day
Schools	With lunch & shower facilities	75 Gallons per student per day
Malls / Retail Areas / Restaurants		0.5 Gallons per square foot per day
Restaurants		1.2 Gallons per square foot per day
Other		ADEQ R18-9 Table 1

TABLE 2 MAXIMUM FLOW GENERATIONS

CLASSIFICATION	PEAKING FACTOR
Sewer lines less than 12 inches in diameter	4
Sewer lines 12 inches and greater in diameter	ADEQ R18-9-E301 with a minimum of 2

B. Hydraulic Criteria

1. Slope:

TABLE 3 MINIMUM PIPE SLOPES

Size (inch)	Design Slope (ft/ft)	Note
Deadend	0.0075*	Obtain City Engineer approval for any request of variance.
8	0.0040	
10	0.0024	
12	0.0019	
15	0.0014	
18	0.0011	
21	0.0009	
24	0.0008	
30 & larger	0.0008	**Obtain City Engineer approval for any request of variance.

*The minimum slope of end run of sewer. This may not be required in isolated cases approved by the City Engineer where the slope causes excessive sewer depths or a d/D is at least 25%.

**0.0008 ft/ft slope is considered to be the minimum reasonable constructible slope for all pipe sizes 24 inches and larger.

2. Capacity:
d/D = 0.75 maximum for all sewers
3. Velocity:
 - a. Minimum – 2.0 fps (flowing full)
 - b. Maximum – 9.0 fps (flowing full)
4. “n” value:
The “n” value of all pipes shall be 0.013.
5. Cover:
Minimum cover shall be 6 feet above top of pipe.
6. The minimum pipe size for sewer mains is 8 inches.

4-1.203 System Layouts:

A. Horizontal Location:

1. Generally, sanitary sewer lines constructed along a street grid should be aligned parallel to, and south or west of the street centerline.
2. Lines should not cross the street centerline except in cases where curvilinear street alignments are encountered, and then only as specified by the City Engineer.
3. Curved sanitary sewer lines are not allowed.
4. A manhole is required for all changes in direction, slope, material, or size of the sanitary sewer line.
5. The horizontal angle formed between the incoming and outgoing lines cannot be less than 90 degrees.
6. Sanitary sewer lines shall be placed under the pavement. When not in the pavement, they shall be placed in a COB sewer easement.
7. In local streets, manholes shall be placed 7 feet from street monument line. On curvilinear streets and knuckles, manholes may be placed 5 feet to 9 feet from the monument line. Alternate locations must be approved by the City Engineer.
8. In collector and arterial streets, manholes shall be centered in a travel lane or on a lane line. Typical standard offsets from street monument lines are 16, 22, 28, 34 feet, etc. However, it is the engineer’s responsibility to ensure that vehicle wheel path criteria are met.
9. The outside of sewer pipe in all streets shall be no closer than 2 feet to the centerline of the roadway and 2 feet to the lip of any gutter or four feet from the back of any curb.
10. When feasible at streets intersecting at tees or 90 degrees, mains shall be extended to end at a single manhole to avoid adding another manhole for a pipe termination. There are no dead-end manholes when an intersecting street has sewer mains.
11. On sewer pipes 15 inches and larger in diameter, the maximum angle allowed is 45 degrees in one (1) manhole. Two (2) manholes shall be constructed to change flow direction more than 45 degrees and up to 90 degrees.

B. Vertical Location:

1. In no case will sanitary sewer lines be installed with less than 6 feet of cover over the top of the pipe, unless otherwise approved by the City Engineer.
 2. Sanitary sewer pipe will be installed at a depth sufficient to ensure gravity drainage of wastewater from each service line and should anticipate the lowest potential finish floor elevation for each building pad.
 3. Pipe design should ensure gravity drainage from the ultimate drainage area and will allow for future extensions of service to adjacent parcels.
 4. All finished floors shall be above the lowest manhole rim elevation where the service connects.
 5. Where the natural ground slope is less than the slope of the sewer resulting in cover issues, there may be no drop across the manhole where the incoming pipe is 0 degrees to 30 degrees from the projection of the downstream line as approved by the City.
 6. All manholes where the incoming line is 0 degrees to 60 degrees from the projection of the downstream sewer, 0.10 foot of drop is required.
 7. All manholes where the incoming line is 60 degrees to 90 degrees from the projection of the downstream sewer, 0.20 feet of drop is required.
 8. Where pipe size changes through a manhole, the crown of the upstream pipe(s) will be equal to or higher than the crown of the downstream pipe
 9. In large trunk lines, inverts at junctions should be designed to maintain the energy gradient across the junction and prevent backflow.
 10. A maximum of one foot of drop across a manhole is allowed without constructing a drop sewer connection.
 11. A manhole with an incoming flow line creating a drop greater than 1 foot and less than 2.5 feet to the outgoing sewer is prohibited.
 12. A drop manhole shall be used when a sewer enters a manhole 2.5 feet or more above the manhole invert.
 13. Drop manholes for pipe sizes 8 inches through 18 inches shall be designed with an inside drop per [COB Detail 41255](#).
 14. For drops on sewer lines larger than 18 inches, specific approval from the City Engineer is required, including a detailed design.
- C. Horizontal Separation:
1. Sanitary sewer lines must maintain a minimum of 10 feet of horizontal clearance to dry utilities.
 2. Provide a horizontal separation from any structural footing or substantial improvement. The separation shall be calculated by a structural engineer and submitted for review and approval.
 3. Provide a minimum horizontal separation of 6 feet on either side of a sanitary sewer to storm drains, water mains, reclaim lines, raw water mains, culverts, box culverts, etc.
 4. All horizontal clearances shall be measured from the largest outside dimension on each utility.
- D. Vertical Separation:
1. Separation of water and sewer mains shall be per the following criteria:
 - a. Caution should be taken in the design and construction of the sanitary sewer lines to protect all water supplies from wastewater contamination.

- b. Water lines will not be allowed to cross under sewer mains, at any depth, without approval of the City Engineer. For this reason, typical vertical realignment construction and details are not applicable. The engineer shall take this into account when preparing preliminary analysis and detailed design plans. To accommodate this requirement, separation criteria and minimum cover requirements of the water main may be allowed, as long as minimum State regulations and MAG Detail 404-1, Zone 'A' criteria are met. When existing shallow sewers are encountered, a meeting should be scheduled with the City Engineer to discuss proposed water and sewer extensions in the areas of shallow conditions.
 - c. If water mains must be installed within Zone 'B' areas, the water main shall be per MAG requirements.
 - d. The City does not allow ductile iron pipe to be used in any gravity sewer mains.
 - e. Concrete encasement shall be formed on each end. Encasement shall end on pipe joints leaving the joint exposed and visible. The encasement may need to extend longer than 20 feet.
2. Sewers shall be separated vertically from all utilities by a minimum of 2 feet.
 3. Where 2 feet of separation is not met, the conflicting utility shall have slurry bedding and backfill to spring line.
- E. Easement Requirements:
1. Easements may be considered in the following cases:
 - a. For single family, individually lotted, residential developments, City sewer mains may be constructed in private streets, meeting the minimum width of 32 feet back of curb to back of the curb, and meet the minimum easement width and requirements below.
 - b. The development route falls in a future ROW alignment.
 - c. The development route falls in a major utility, canal, or drainage channel corridor.
 - d. For a short segment of sewer main, such that it is not technically feasible to design the sewer mains in the ROW and the proposed alignment of the sewer main in an easement results in more efficient operation of the sewer network.
 2. All City sewer mains proposed outside of the ROW require approval of the City Engineer.
 3. Sewer Line Easement
 - a. Sewer lines outside of a public ROW are required to be located within an exclusive easement granted to the City by the landowner in accordance with City requirements. PUE's are not acceptable.
 - b. Such easement shall be free from any dry or private utilities running parallel to the sewer. No other non-City utilities are allowed in a City easement.
 - c. All City sewer easements shall be located in tracts, open space, or public access easements. In no case shall the sewer easement be located on residential lots.
 - d. The minimum easement width shall be per Table 4 Minimum Easement Widths for Sewer Mains
 - e. The minimum easement widths may be increased by the City Engineer to accommodate construction or maintenance activities or topographical challenges.
 - f. All sewer mains located within an approved private access way shall have a minimum

easement width of 25 feet, back of curb to back of curb. The private access shall have 10 foot PUE's on both sides to accommodate the other utilities.

- g. Sewer mains are to be located in the center of the easement. In special cases with City Engineer approval, the sewer can be offset in the easement but never closer than 15 feet to the edge of the easement.
- h. For sewer easements not located within public or private access, all-weather access is required. The access road shall have a minimum width of 10 feet and shall be paved or constructed of a minimum 6-inch-thick stabilized decomposed granite of MAG ABC. Each end of the access road shall connect to a public street, or private access way or turn-around easement shall be provided. The maintenance of access roads in which the easement(s) is located is the responsibility of the property owner or HOA and shall be indicated as such in the CC&R's. A copy of the CC&R's providing evidence of this maintenance responsibility by the HOA or other ownership group shall be submitted to the City for verification.
- i. Sewer easements shall not have a slope greater than 10:1 or 10% in any direction.
- j. The easement shall not be located in a fenced area or areas with restricted access and will be accessible at all times to City service equipment such as trucks, backhoes, etc.
- k. No new cacti are allowed within a sewer easement. Native cacti will be allowed.
- l. Trees can only be located in the outer 10 feet of the easement when the easements are 40 feet or larger and the pipe is centered in the easement. The only landscaping allowed within the entire easement is average size shrubs and ground cover. If at any time the City needs to exercise its right to use the easement, it is not the City's responsibility to replace any landscape damaged or destroyed.
- m. No landscaping shall be placed within an easement, which would render the easement inaccessible by the equipment. The City may cause any obstruction to be removed without notice to the property owner, and all related costs shall be the property owner's responsibility. The maintenance of all landscaping in easements is the responsibility of the property owner or HOA and shall be indicated as such in the CC&R's. A copy of the CC&R's providing evidence of this maintenance responsibility by the HOA or other ownership group shall be submitted to the City for verification.
- n. Sewer easements shall be free and clear of improvements, i.e., screen walls, fences, retaining walls, and other obstructions.
- o. Proposed developments with buildings, building foundations, building slabs or other structural elements proposed to be closer than 20 feet from an easement boundary, shall be required to submit structural and soil calculations, signed and sealed by a registered Arizona professional engineer, which verify the integrity of structures adjacent to the sewer main under the influence of the adjacent structures footing.
- p. If the sewer crosses a wash, access is required from both sides of the wash. In the case where the wash is not passable with a typical maintenance vehicle, a widened easement is required on both sides of the wash to provide a turn-around area.
- q. Sewer easements or ROW dedication shall be through a map of dedication or final plat or by separate instrument with prior City Engineer approval.
- r. All real property to be conveyed to the City, or real property interests granted to the City through an easement, shall first comply with the City requirements set forth in Chapter 25 of the City Code.

TABLE 4 MINIMUM EASEMENT WIDTHS FOR SEWER MAINS

Main Diameter	Cover Depth	Minimum Easement Width
15 inches and less	<10 ft.	35 ft.
15 inches and less	10-15 ft.	40 ft.
15 inches and less	15-20 ft.	45 ft.
15 inches and less	>20 ft.	50 ft.
16 to 30 inches	<10 ft.	40 ft.
16 to 30 inches	10-20 ft.	50 ft.
16 to 30 inches	>20 ft.	60 ft.
Greater than 30 inches	Any	80 ft.

4. Sewer and Water Main Easements

- a. When sewer and water mains must be placed in a common exclusive easement to be granted to the City, the following criteria shall apply:
 - i. The sewer main shall be typically located in the center of the easement. To place a water main in a common water and sewer easement, calculate the sewer easement as normal then add an additional 15 feet for less than 8 feet deep water main.
 - ii. The water main shall be located 15 feet from the edge of the total easement opposite the sewer.
 - iii. For water mains greater than 8 feet deep use, half of the value in [Table 5](#) per “Design Standards – Section 3-1 Water Engineering Design Standards” in addition to the sewer easement.

4-1.204 Sewer Services:

- A. Individual properties or individual buildings shall have individual services.
- B. Sewers serving multiple properties and or multiple buildings are not considered a service and shall be designed as a private main extension.
- C. Private main extensions require two manholes to be placed on a private connection to the public sewer main. The first manhole shall be placed on the public sewer main and the second manhole shall be placed adjacent to the ROW or PUE line on private property. The manhole adjacent to the ROW or PUE on private property shall be labeled as a private manhole and all upstream sewer mains and appurtenances shall be private.

TABLE 5 MINIMUM DIAMETERS FOR SERVICE

Type	Size
Residential	4 inch
Multi-Family	6 inch
Commercial	6 inch

- D. The engineer shall use existing sanitary sewer services that have been stubbed out to a property by previous construction. Where the use of stubbed-out services is not feasible, the existing line shall be removed and capped at the main or manhole. If the existing service is connected to a manhole,

the trough of the manhole shall be rebuilt to conform to the active lines.

- E. Horizontal bends are not allowed within the ROW or PUE.
- F. Each residential lot or building shall be provided with its own individual service.
- G. Each commercial or industrial lot of a commercial or industrial project shall have an individual service that allows enough space or distance for grease traps, sediment traps, and/or monitoring/metering vaults to be installed prior to the connection to an onsite or offsite sewer main.
- H. Commercial and industrial developments having more than one building require a private main.
- I. Routine dipping of water mains to allow sewer services to cross will not be allowed.
- J. Marker balls per MAG 440 shall be installed.
- K. Location:
 - 1. All service line connections shall be installed perpendicular to the sewer main.
 - 2. All services shall be marked with a steel stud painted green. The service location shall also be stamped in the curb using an “S” to mark the location.
 - 3. All sewer services shall be 5 feet deep at the PUE.
 - 4. Opposite side service taps must be a minimum of 3 feet apart.
 - 5. All same side services shall be 6 feet apart.
 - 6. Sewer services shall not be located closer than 3 feet to the property line.
 - 7. Sewer services shall not be located closer than 6 feet to a manhole.
 - 8. Sewer services must also be located a minimum of 10 feet from water services.
 - 9. The engineer shall coordinate all utilities to avoid conflicts with the sewer service.
 - 10. Sewer services shall not be installed under or within 2 feet of driveways.
- L. Sanitary sewer mains shall be designed to allow for the sanitary sewer service lines to pass under water mains with 12 inches of vertical clearance to comply with clearance requirements.
- M. When sewer services exceed the maximum slope allowed, a COB deep sewer service shall be used.
- N. Service Line Connection to Large Diameter Sanitary Sewer Lines:
 - 1. Sewer services are allowed on pipes up to and including 12 inches in diameter.
 - 2. Services on mains larger than 12 inches in diameter require City Engineer approval, and if approved, require a manhole to make the connection. Tapping directly into the pipe is not allowed.
- O. Service Line Taps into Manholes:
 - 1. Service line taps into manholes are not allowed except where additional manholes would be required, such as at knuckles or cul-de-sacs.
 - 2. There shall be no more than 4 penetrations into a manhole when the mains are 12 inches and smaller.
 - 3. Services are not allowed when there are 3 mains connecting to a manhole.
 - 4. Services are not allowed when there are one (1) or more incoming pipes that are larger than 12 inches.

5. Service taps into manholes require the flow line of the service tap to match the highest crown of the sewer main.
- P. Service connections to existing mains:
1. All taps to existing mains shall be core drilled or hole sawed with a COB approved bit. Chop sawing or breaking out of the main is not allowed.
 2. A COB approved service saddle appropriate for the pipe material shall be used.
 3. Any time a sewer main is tapped, a new service line to the ROW is required.
 4. Where a service connection to an existing main is made an "S" shall be ground in the existing curb directly over the new service.
- Q. Pressurized Connections:
1. There shall be no pressurized connections made directly into gravity sewer mains.
 2. All pressurized sewer connections shall be made:
 - a. At a gravity service connection if residential.
 - b. At a force main manhole if non-residential.

4-1.205 Manholes:

- A. Manholes are required at distances not to exceed those in the Manhole Spacing Table, and at all changes of grade, pipe size, pipe material, alignment, permanent pipe terminations, and all force main terminations.

TABLE 6 MANHOLE SPACING

PIPE DIAMETER (inches)	MAXIMUM MANHOLE Spacing (feet)
8-15	400
18-30	500
36 and over	600

- B. Manhole Diameters
1. For mains, 15 inches and smaller that are less than 10 feet in depth can use 4-foot diameter manholes with 24 inch rings and covers.
 2. For all mains that are 10 feet and greater in depth a minimum of 5-foot diameter manholes with 30-inch ring and cover are required.
 3. For mains, 15 inches through 30 inches require a minimum of 5-foot diameter manholes with 30-inch ring and cover.
 4. All mains larger than 30 inch require special design for all manholes and structures.
- C. Water stops are required.
- D. Approved COB coatings shall be used in the following locations:
1. All manholes in arterial and collector streets.
 2. All 5-foot diameter or larger manholes.

3. All manholes on sewers 18-inches and larger.
 4. All manholes with a flow line difference greater than eight inches.
 5. Manhole coating is required to be placed on the entire interior of the manhole. There shall be no exposed concrete.
 6. Alternative manhole materials to eliminate manhole corrosion are acceptable as approved by the City Engineer.
- E. Manhole Frames and Covers: [COB Detail 41260](#)
1. Manhole covers are to be per MAG Standard Detail 423-1 and 423-2.
 2. The words “Buckeye Sanitary Sewer” shall be lettered on the manhole lid with the COB logo for public sewer mains.
 3. Private sanitary sewer manhole lids shall be lettered with the words “Private Sanitary Sewer”.
 4. All frames and covers shall be water tight.
- F. For mains 36 inches and larger in diameter, a special design is required for the manhole or structure.
- G. Precast Manholes Bases: [COB Detail 41250-1](#) and [41250-2](#)
1. Shall have integrally cast gaskets or pipe bells.
 2. Shall be monolithically cast, base and shaft.
 3. Shall be rebar reinforced.
 4. Shall have a structural design.
 5. Shall have anti-flotation ring.
 6. If approved by the City Engineer:
 - a. Pipe openings may be core drilled,
 - b. The entire base shall be lined with a COB approved lining system, or
 - c. Pipe boots used shall have no exposed metallic material.
 7. No grouting of the annular space between the pipe and rubber seal.
 8. Shall have an eight-inch MAG ABC base compacted to 100 percent relative density, on undisturbed native soil.
- H. Cast in Place Manhole Bases:
1. Require City Engineer approval.
 2. Bases shall be formed to provide a plumb vertical surface for pipe penetration.
 3. All connections to bases shall be per the [COB Detail 41250-1](#).
 4. Shall be poured on compacted sub-grade per MAG Section 601.
- I. Drop Manholes:
1. Drop manholes are to be avoided whenever possible, due to increased maintenance issues, generation of odors due to the turbulence of flow, and safety hazards for maintenance personnel.
 2. A drop manhole is to be used when a sewer enters a manhole 2.5 feet or more above the manhole

invert.

3. Drop manholes shall be done as an inside drop on the inside of the manhole:
 - a. The inside drop shall be a manufactured system that has a large “bowl” type device that “catches” the sewage from the incoming main. Standard fittings are not acceptable.
 - b. The manhole diameter shall be four feet larger than the largest protruding piece from the manhole wall.
 - c. For 8 inch and ten-inch sewers a 5-foot diameter manhole is required.
 - d. For 12 inch and 15 inch sewers a 6-foot diameter manhole is required.
 - e. Drops on sewers 18 inches, and larger require a special design and a specific detail from the engineer as well as approval from the City Engineer.
 4. When the drop is constructed inside the manhole, the entire manhole shall be lined. The lining shall fully encapsulate the drop connection and all hardware used for mounting it to the manhole wall. This shall be a uniform and seamless application to ensure no sewer gasses can penetrate to the hardware.
 5. The MAG drop manhole is not allowed.
- J. Irregular Structures:
1. Irregular structures within the sewer system, include, but may not be limited to:
 - a. Engineered junction structures for larger diameter sewers, or numerous pipes within a single structure.
 - b. Flow splitter structures.
 - c. Flow metering structures.
 - d. Monitoring manholes and vaults.
 - e. Large diameter manholes with flat tops (underground or at grade).
 - f. Offset manholes (sewers entering/exiting manhole at non-centerline positions).
 - g. Pump station or lift station wet wells.
 2. Specific considerations for irregular structures may include, but not necessarily be limited to:
 - a. Access hatches and personnel accessibility, structure coatings, odor control facilities, fillets for solids control, site access and easement considerations, site fencing, and ventilation considerations.
 3. All irregular structures shall have a complete structural design with design drawings to be constructed. These drawings shall be part of the sewer plans for review and approval.
- K. Wash Crossing and Floodplains:
1. Manholes shall not be located within the banks of any wash.
 2. When manholes are located within 20 feet of the wash, bank erosion protection is required on the wash bank to protect the manhole. The minimum amount of protection allowed is a riprap blanket appropriately sized for the wash.
 3. When manholes are located in or adjacent to a floodplain, wash or basin, the rim of the manhole shall be set at an elevation one foot above the 100-year water surface elevation.

4. If at any time it is estimated that there will be water above the rim of the manhole or there is potential for floating a manhole, a MAG Detail 523-1 and 523-2 pressure manhole shall be installed.
5. All manholes shall have a 10-foot radius around the outside of the manhole that is one foot above the adjacent 100-year water surface elevation.
6. All manholes shall have an access and maintenance road that is one foot above the adjacent 100-year water surface elevation.

L. Force Main Manhole:

1. All force mains or pressure main discharge locations shall terminate in a specific manhole to serve only the force main.
2. The force main manhole shall be located on an appropriately sized lateral pipe, not the sewer main.
3. This manhole shall be located out from under existing and future pavement.
4. All force main manholes, as well as the manhole where the force main lateral ties into the existing sewer main shall be lined or constructed with epoxy based materials.
5. All force mains shall enter the manhole at 0.20 feet above the outgoing flow line.
6. All force main manholes shall have a COB approved odor control system installed.

4-1.206 Testing Cleanouts:

A. Requirements: [COB Detail 41270](#)

1. Permanently installed cleanouts within the COB ROW will not be allowed.
2. Testing cleanouts (TCO) may be used on temporary sewer line extensions up to 150 feet in length.
3. TCO's shall be placed on sewer lines that are to be extended in the future.
4. TCO location shall be beyond any proposed pavement edge by at least 10 feet or more, as sewer depth dictates.
5. Sewer plugs in lieu of TCO's must be approved by the City Engineer.
6. The "T" fitting shall be the same size as the sewer main. The riser shall be 8 inches.
7. The testing cleanout shall terminate at the surface in a typical meter box marked "sewer".
8. A watertight cap shall be placed on the cleanout within the box.

4-1.207 Monitoring Structures:

- A. Chapter 16 of the City Code may require a "control manhole" otherwise known as a sewer monitoring structure. These structures are for use by the COB and the building owner.
- B. When a monitoring location is required by the City, the only sewer allowed to go through the monitoring structure is from the building being monitored. No other sewer is allowed to flow through the monitoring structure.
- C. There are two types of structures used: one is a monitoring vault the other is a monitoring manhole.
- D. Monitoring structures shall be labeled with the address of the building being monitored.
- E. All monitoring structures shall be maintained by the property owner.

- F. All monitoring structures shall have hatches rather than manhole frames and covers. All hatches shall be rated for H₂₀ loading and be equipped with a hydraulic opening assist mechanism.
- G. Monitoring Vaults: [COB Details 41280-1](#) and [41280-2](#)
1. Generally, properties in industrial zoned areas with a projected wastewater discharge of 25,000 gallons per day or more will be required to install a monitoring vault.
 2. When a sampling device is required either full-time or periodically, a monitoring vault is required.
 3. Monitoring vaults are required when a development is required to do flow monitoring.
 4. Monitoring vaults are required if the nature, concentration, and amounts of all pollutants currently discharged to the public system do not meet the requirements of Chapter 16 of the City Code.
- H. Monitoring Manholes:
1. The Water Resources Department may require a developer/landowner to install a monitoring manhole. Generally, commercial, industrial properties with potential mixed uses, restaurants and developments that will use chemicals or solvents could be required to install monitoring manholes.
 2. Monitoring manholes shall be constructed per MAG with a straight channel and without taps or bends for ten feet upstream or downstream or as approved by the City Engineer. The design of monitoring manholes for peak flow rates greater than 40 gallons per minute shall be approved by the City Engineer.

4-1.208 Wash Crossings:

A. Wash Classifications

1. Bury requirements to place sewer mains under washes or channels shall be based upon the 100-year, six or 24-hour peak design discharge (Q100), including scour depth considerations in the channel or wash.
2. All wash crossings will be designed to have the sewer main a minimum of three feet below the scour depth of the wash. See [Table 7](#) Minimum Depth of Bury For Washes for the minimum criteria that shall be used for wash crossings.
3. Wash crossings with a 100-year flow above 500 cfs will use the Arizona State Standard Attachment SSA 5-96, Guideline 2, Level 1, as published by the ADWR to estimate the scour depth. The engineer will estimate the depth of scour and design the top of pipe to be three feet below the estimated scour depth. The engineer will provide a detailed analysis of the scour depth with final plans or in the final sewer report for review and approval.
4. All pipelines shall be located out of the scour zone.

TABLE 7 MINIMUM DEPTH OF BURY FOR WASHES

100-year flow rate	Minimum depth of bury
1 to 49 cfs	6 feet
50 to 99 cfs	7 feet
100 to 499 cfs	8 feet
Greater than 499 cfs	Scour depth based on scour analysis minimum 8 feet

B. Grade Control Structure or Rip-Rap Blanket:

1. All sewer lines that do not have the minimum cover shall be protected from erosion. Erosion protection can be by a rip-rap blanket or grade control structure.
 2. The grade control structure shall be a FCDMC approved structure. The rip-rap and grade control structure shall be sized appropriately for the size of wash.
 3. If the sewer has less than three feet of cover within the wash, the sewer shall be installed in a casing. The casing shall be anchored in such a manner that if exposed due to erosion, it can withstand the hydraulic loading of the wash against it. This type of installation will require a complete design from the engineer as well as City Engineer approval.
- C. Rip-Rap Blankets:
1. Require a minimum of 24 inches thick.
 2. Require a minimum of crushed angular rock with a 12 inch D_{50} gradation.
 3. Require a minimum width, centered on main, of 16 feet plus the pipe diameter.
 4. Require a minimum length and
 - a. Shall be the width of wash tract unless control structures are built to keep the wash from meandering.
 - b. Shall be 20 feet either side of manholes.
 5. All dimensions are minimum and shall be verified with engineering design.

4-1.209 Main and Manhole Protection:

- A. Any manhole that has been proposed in what is deemed by the City to be in “harm’s way” requires approval by the City Engineer. If approved, an engineered design shall be required to fully protect the manhole. Requirements for protection of the manhole shall be determined in the City’s sole discretion.
- B. Any sewer main that has been proposed in what is deemed by the COB to be in “harm’s way” requires approval by the City Engineer. If approved, an engineered design shall be required to fully protect the sewer main. Minimum protection of a main may consist of a concrete cap, rip rap blanket, steel casing, or other engineered design. Requirements for the protection of the main shall be determined in the City’s sole discretion.
- C. Anytime a sewer main is blocked for 20 feet or greater from the surface by items such as multiple storm pipes, box culverts, 404 washes, ROW not controlled by the City, or other items; the sewer shall be constructed in a casing per City requirements and Detail 41290.
- D. If the sewer is located outside the pavement or with less than 6 feet of cover, the City may require a concrete cap to be placed on the sewer.

4-1.210 Easement Abandonments:

- A. Requirements:
 1. Written requests for the abandonment or termination of public sewer easements shall be submitted to the City Engineer.
 2. All existing utilities within an easement to be abandoned or terminated shall be relocated and removed out of such easement with prior approval of the City Engineer and at no cost to the City.
 3. All requests for easement abandonments and terminations require the approval of the City

Engineer.

4. If a sewer main is to be abandoned within the abandoned easement, removal of the sewer main is required.

4-1.211 Private Sewer Mains:

A. Within ROW:

1. Private sanitary sewers are not permitted within PUE's.
2. Private sanitary sewer lines located in public ROW are only allowed if the lines are owned and operated by a private utility company authorized by the ACC.
3. All on-site private sanitary sewer lines must meet the MCESD and the COB Building Code requirements for approval.
4. Private sanitary sewers authorized to be installed within City ROW shall be pursuant to the private utility company's requirements, except for structure location, which the City may dictate in order to minimize impact on traffic and roadway features within the City, such as manhole frames and covers.

B. Outside of ROW:

1. All on-site private sanitary sewer lines must meet the MCESD, AAC, or the COB Building Code requirements for approval.

4-1.212 High Groundwater Areas:

- ##### A. High groundwater levels have been identified adjacent to the Gila River extending northerly to the Buckeye Water Conservation and Drainage District Canal. This area is referred to as the "Waterlogged Area" in the City Water Resources Plan. It is noted in the Water Resources Plan that the depth to groundwater is less than five feet at the Central Wastewater Treatment Plant. For gravity sewer improvement plans that propose installation of improvements within the high groundwater area, the following additional requirement shall be included with the design plan submittal.

B. General Requirements:

1. A geotechnical engineer shall prepare and submit for approval a groundwater investigation plan that characterizes the expected groundwater levels along the alignment of the work and investigates the composition of the soils that constitute the zones of sewer foundation and trench.
2. Buoyancy of sewers shall be considered and flotation of the pipe and manholes shall be prevented with appropriate construction where high groundwater conditions are anticipated.
3. The geotechnical report shall propose effective mitigation measures for the dewatering of trenches and excavations, possible trench shoring methods, and identify locations to discharge any extracted groundwater. The report shall address the effects of the high groundwater during and after construction.
4. The design shall consider measures to preclude flotation of the work, during and after construction. The design shall additionally include any measures adopted from the geotechnical report.
5. The plans will note in profile the water depth information obtained in the investigation stage and any measures to mitigate the effects of high groundwater.
6. The design shall address possible mitigation of the groundwater and any transport of "fines"

within the bedding and backfill zones.

4-1.300 **Plan Preparation:**

4-1.301 **General Requirements:**

- A. All plans shall comply with “Design Standards - Section 1-2 Plan Submittal Requirements” General Construction Notes and Standard Sheets for Infrastructure Plan Submittals.

4-1.302 **Design Plan Requirements:**

- A. All plans shall be neat and legible.
- B. All plans shall be drawn to scale.
1. The Horizontal scale shall not be smaller than 1:40 feet on plan views.
 2. The Vertical scale shall not be smaller than 1:4 feet on profile views unless otherwise approved by the City Engineer.
- C. A Summary of Quantities is required on the cover sheet. The minimum items listed in [Table 8](#) are as follows:

TABLE 8 SUMMARY OF QUANTITIES TABLE

Description	Unit	Quantity
Sewer Main	Linear Foot (LF)	
Sewer Service	Each (EA)	
Manholes	Each (EA)	
Cleanouts	Each (EA)	
Drop Manholes	Each (EA)	
Pipe Encasement	Linear Foot (LF)	
Residential / Commercial taps to an existing Main	Each (EA)	
Monitoring Vault / Special Structures	Each (EA)	
Provide separate Summary of Quantities tables for City sewer quantities and private sewer quantities.		

- D. Plans shall have only one plan and profile per sheet.
- E. Sewer design is the only design allowed on the sewer plans, no other utility designs allowed.
- F. Plans shall not be phased.
- G. All design shown shall be constructed under one permit and construction sequence.
- H. All public sewer lines shall be profiled. This includes all laterals and pipe stubs greater than five feet in length.
- I. All commercial services within the ROW shall be profiled.
- J. Sewer mains are required to be stationed along the center line of the main.
- K. Stationing for sewer services shall reset to 0+00 at the lowest manhole of each run and be reset for each sewer segment between manholes.
- L. All profiles shall include the following information:
1. Pipe sizes, length, slope, and pipe material.
 2. Manhole invert(s), rim elevations, and manhole number.

3. Manhole station and centerline station.
 4. Invert elevations at the end of all pipe stub and commercial services.
 5. Existing and proposed ground.
 6. All utilities that cross or are proposed to cross and are within three horizontal feet of the proposed sewer shall be shown in the profile.
 7. All utilities within three vertical feet of the sewer shall have an invert elevation and a calculated vertical separation shown. All vertical separations shall be calculated, taking into account the pipe wall thicknesses. All separation dimensions shall be from outside of the pipe to outside of pipe.
 8. Show and label all separation remediation protection, including concrete encasement of sewers, steel casing, etc.
- M. All plan views shall contain the following information:
1. Manhole numbers, manhole station, center line station, (same stationing used on the paving plans), monument/brass cap stationing.
 2. Sewer service stationing with the label of service type (standard service, deep service, or pressure service).
 3. All separation remediation protection including concrete encasement of sewers, steel casing, etc. shall be labeled and shown.
 4. In the case of knuckles and cul-de-sacs, the service shall be stationed at the main line connection. An additional dimension from the nearest property line to where the service crosses the ROW line shall be shown.
 5. Services into manholes shall be additionally dimensioned from the nearest property line to where the service crosses the ROW line.
 6. All easement information, including widths, slopes, access roads, etc.
 7. All finished floor elevations must be shown to determine if a backwater valve is needed.
 8. Backwater Valves: On service locations where the finished floor of the structure to be served is less than 6 inches above the rim of the upstream manhole on the sewer main, a backwater prevention valve shall be placed on the service line at a location determined by the City Building Official. Any lot requiring this valve shall be identified on the sewer plan and included in a Summary Table of all such valves. This information will be provided to the Building Official for subsequent enforcement of home or building construction.

4-1.303 Submittal Requirements:

- A. Plan Review Submittals:
1. Sewage lift stations and force mains require separate plans submittals in accordance with the respective sections of the Wastewater Design Standards.
 2. In addition to bond copies, a physical, electronic copy with the following items is required to accompany the plans submitted to the City for signature:
 - a. The base map for the area on the plans seeking approval, including all property lines, ROW, PUE's, easements, etc.
 - b. All sewer mains, manholes, services, and other wastewater items shown and located

properly.

- c. All the information shall be shown on a single map, not cut sheets like the plans, and located on reasonable layers in CAD.

B. Plan Revisions or Re-Approvals:

1. City approval of plans and associated design reports are valid for one year from the date of the City Engineer's signature.

4-1.400 Materials:

A. Submittals:

1. All materials used on the project or incorporated into the construction are subject to approval or rejection by the City Engineer.
2. The City approved technical material/manufacturer data is required for all pipe materials and appurtenances used on the project before work commences.
3. All delivered materials shall match the approved technical data, or it will be rejected.
4. The contractor shall submit four copies of the submittals to the City Engineer.
5. All work installed prior to the approval of submittals is subject to rejection by the City.
6. A copy of the approved material submittals shall be on the Jobsite at all times.
7. Each of the submittals shall clearly show the manufacturer and have comprehensive technical data for the proposed product.
8. All material submittals shall be submitted at or before the pre-construction meeting for review and approval by the City Engineer.

B. Pipe Material:

1. Allowable materials for public sewer:
 - a. Four inch through 30-inch pipe shall be VCP (ASTM C700).
 - b. If 30 inch or larger VCP is not available, a letter from the VCP manufacture shall be provided to the COB. After the letter is reviewed and approved by the COB the greater than 30 inch materials can be used for 30-inch diameter pipe and larger.
 - c. For pipe sizes greater than 30 inches' sewer lines can be C-905 PVC Pipe DR 14, Centrifugally Cast Fiberglass Reinforced Polymer Pipe, or triple wall polypropylene. All materials require special design approval.

C. Pipe Zone Material:

1. Pipe zone material shall be:
 - a. No. 57 rock as tested per ASTM D448.
 - b. MAG ABC per MAG Section 702.
 - c. Controlled low strength material (CLSM) slurry per MAG Section 728.

D. Manholes:

1. Cast-In-Place Base:
 - a. Cast in place manhole shall conform to MAG Section 625, ASTM C478.

- b. The contractor shall provide prior to construction:
 1. The concrete to be used in the base (per ASTM C478).
 2. Any reinforcing to be used in the base.
 3. The 48-inch shaft and cone material (ASTM C478).
 4. The 60-inch shaft and cone material (ASTM C478).
 5. Manhole adjusting rings (ASTM C478).
 6. Manhole lining system.
 7. Manhole joint sealant.
 8. Type of water stop.
 9. The 30-inch frame and cover.
 10. The 24-inch frame and cover.

2. Pre-Cast Base:

- a. A comprehensive shop drawing for each manhole is required. The shop drawings shall include but not be limited to the following information: manhole number per the approved plans, pipe sizes, invert elevations, angle of inverts, size of precast base, type of gasket system proposed, dimension of the anti-flotation ring, etc.
- b. The contractor shall provide prior to construction:
 1. Type of gasket proposed
 2. The reinforcing to be used in the base
 3. The 48-inch shaft and cone material (ASTM C478)
 4. The 60-inch shaft and cone material (ASTM C478)
 5. Manhole adjusting rings (ASTM C478)
 6. Manhole lining system
 7. Manhole joint sealant
 8. The 30-inch frame and cover
 9. The 24-inch frame and cover

E. Manhole Lining Systems:

1. All manhole lining systems shall be spray applied.

4-1.500 As-Built Drawings:

4-1.501 General Requirements:

- A. All plans shall comply with Section 1-2 General Construction Notes and Standard Sheets for Infrastructure Plan Submittals – Plan Submittal Requirements.

4-1.502 "To Pave" As-Built Drawings:

- A. This review is to identify any underground issues that may have been missed during construction. These issues can more easily be fixed prior to the placement of the pavement; therefore, "To Pave"

As-Built drawings are required prior to paving. Street paving shall not be permitted to start prior to the approval of these as-built drawings.

- B. "To Pave" As-Built drawings required for submittal:
1. Manhole stations, including offsets.
 2. All plan inverts shown.
 3. All utility crossing dimensions and separations (outside of utility to outside of utility).
 4. All pipe length, pipe slope, pipe sizes, and pipe material.
 5. All service stationing and dimensions.
 6. Horizontal location of the sewer, including dimensioning from center line.
 7. All sewer services located.
 8. All offset dimensions to the property line shall be As-Built.
 9. Dimensions shown from centerline to sewer line are to be As-Built.

4-1.503 "For Final" or "Final" As-Built Drawings:

- A. "For Final" As-Built drawings required for submittal:
1. Sewer manhole rim elevations to be As-Built after paving and adjustments are completed.
 2. All monuments and brass caps shall be As-Built

4-1.504 Tolerances and Corrections:

- A. Sewer As-Built review is separate from construction inspection and field quality control measures.
- B. All field identified problems shall be corrected prior to As-Built drawing review commencing.
- C. Deviations as a result of construction activities may be allowed by the City, but deviations beyond certain limits will not be allowed. Any deviation allowed by the City will be determined in the City's sole discretion. In these cases of non-compliance, the sewer shall be removed and replaced at the Developer/Landowner's expense. A partial listing of unacceptable sewer installations is shown below:
1. An 8-inch sewer slope: 0.0030 ft/ft or lower
 2. A 10-inch sewer slope: 0.0018 ft/ft or lower
 3. A 12-inch sewer slope: 0.0015 ft/ft or lower
 4. A 15-inch sewer slope: 0.0012 ft/ft or lower
 5. A 18-inch sewer slope: 0.0009 ft/ft or lower
- D. Other installations that may not be acceptable to the City include the following:
1. Manholes located within one (1) foot of the lip of gutter or street centerline.
 2. Manhole flow lines with a negative grade.
 3. Manhole as-built invert elevations outside of MAG tolerances.
 4. Sewer services not constructed to the designed property.
 5. Separation from water main that violate the MAG Zone "A" tolerances.

[END OF SECTION]

Appendix 1 Standard Details

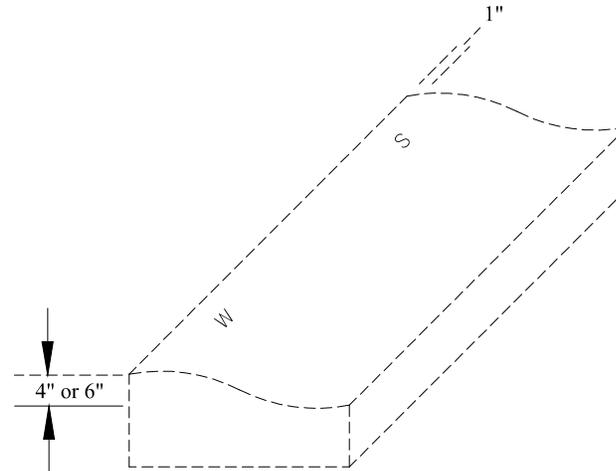
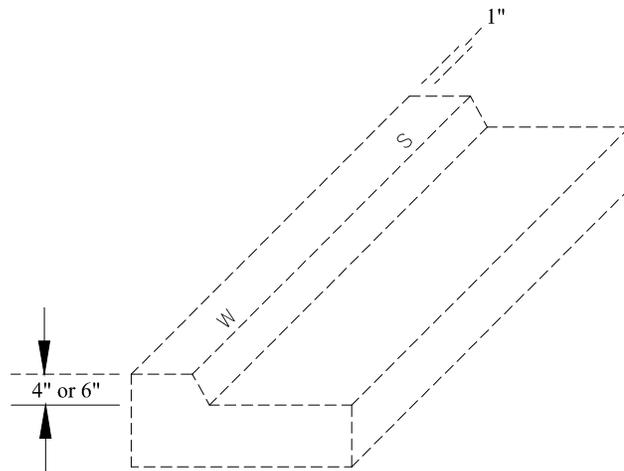
41100-1	Sewer Construction Notes Page 1 of 2
41100-2	Sewer Construction Notes Page 2 of 2
41220	Service Brand Detail
41230	Service Line Connection Stationing
41235	Sewer Service(s) in Manholes
41240	Deep Sewer Service
41243	Residential Pressure Service Connection
41250-1	48", 60", or 72" Precast Manhole Base
41250-2	48", 60", or 72" Precast Manhole Base
41253	Cast in Place Manhole Base – Clay Pipe
41255	Sewer Inside Drop Manhole
41260	City of Buckeye Logo
41270	Testing Cleanout
41280-1	Monitoring / Sampling Vault
41280-2	Monitoring / Sampling Vault
41290	Casing Pipe and Spacer
41300-1	Vitrified Clay Pipe Trench Detail Types 1-6
41300-2	Vitrified Clay Pipe Trench 4" – 36"
41300-3	Flexible Sewer Pipe Trench Design 30" to 78" +
41310	Concrete Cap

1. Backfilling shall not be started until all piping is inspected and approved by the COB inspector.
2. All sewer mains shall be pressure tested and mandrel tested (for flexible pipe) per MAG specifications. For flexible pipe, Contractor shall not commence testing within 30-days of installation.
3. For flexible pipe, upon completion of testing and flushing, all sewer lines shall be video inspected not sooner than 30 days following backfilling with the CD/DVD provided to the City.
4. Steps shall not be allowed in manholes.
5. All manhole rings and covers to be cast iron per MAG. Manhole lids shall have the COB logo imprinted on it.
6. All new service taps shall be a wye type. Taps to existing mains shall be wye or "T" type.
7. All taps to existing mains shall be core drilled or hole sawed with a COB approved bit. No chop sawing or breaking out of the main is allowed. A COB representative from the Water Resources Department shall be on site during ANY tapping of existing mains. A COB approved saddle shall be used for the tap connection.
8. All sewer line compaction shall be MAG Backfill Type 1 per MAG section 601 and includes compaction of the bedding to 95%. Backfill around manholes shall be MAG Backfill Type 3 backfill per MAG section 601.
9. All sewer service connections shall be extended a sufficient distance beyond the PUE lines to clear all facilities to be installed in public utility easements which parallel the street right of way.
10. Approved COB coating shall be used in the following locations: All manholes in arterial streets, all 5 foot diameter or larger manholes, all manholes on sewers 18 inch and larger all manholes with a flow line difference greater than 8 inches. All coated manholes shall be tested per AAC Title 18.
11. All manholes shall be vacuum tested in accordance with Arizona Administrative Code. Vacuum testing shall only commence after final paving and final adjustment of the ring and cover.
12. Where manholes are located outside of the street or sidewalk there shall be a class "B" concrete ring 6 inches thick and 12 inches wide with fiber mesh placed around the manhole frame and cover flush with the top of the frame. The manhole frame shall be set 6 to 12 inches above finish grade. There shall be a No 4 reinforcing bar centered in the concrete. A green carsonite marker shall be installed.
13. All manholes greater than 10 feet deep from rim to the lowest invert shall be 5 feet in diameter.
14. All materials shall be new and undamaged. Any pipe showing evidence of degradation shall not be accepted. All rejected material shall be removed from the site immediately, or a cease work order will be issued.
15. All underground utilities shall be installed and completely backfilled prior to the testing of the COB infrastructure. In the event private and/or public utilities need to be re-excavated the prior test of the COB facilities will be considered null and void and retesting will be at the Contractors expense.
16. No upstream sewer construction shall start until the downstream sewer main is completed and approved by the COB inspector. Pipe laying shall commence at the proposed project outfall on the existing COB sewer and proceed up stream. Any exceptions to this specification shall be approved in writing by the City.
17. A MAG standard detail 427 plug shall be installed in the furthest downstream manhole and remain in place until all sewer testing and cleaning is completed. Removal of the plug shall only be done with the supervision of the COB inspector. Under no circumstances shall the plug be removed prior to COB inspection. In the event that the plug is removed, the contractor shall at his expense, clean with a hydro-vac the sewer main downstream to a location approved by the COB inspector to adequately remove all debris carried into the COB main. Should the sewer plug fail prior to the COB inspection the contractor shall at his expense, clean with a hydro-vac the sewer main downstream to a location approved by the COB inspector to adequately remove all debris carried into the COB main. A video inspection after cleaning will also be required of the existing main and all expenses will be paid by the Contractor. Any damages or cleaning expenses at affected lift stations and levied fines shall be paid for by the Contractor. The Contractor shall also be liable for any damage to private property and/or environmental damage/clean up.



(cont.)

18. COB approved manhole coating/lining systems shall be spray-on such as Raven, Spectrashield, etc. All coatings shall be approved by the COB.
19. All manhole bases shall be precast per COB details. Cast-in-Place Manhole Bases will only be allowed with approval by the City.
20. No ferris material shall be used on the interior of the manhole unless completely coated with a COB approved coating.
21. Any curb and gutter removed with utility markings shall be replaced and the utility marking shall be re-stamped in the curb.
22. Material shall be submitted at or before the pre-construction meeting and are required to include:
 - 22.1. 24" and 30" Frame and Cover
 - 22.2. 48", 60", and 72" Manhole Shaft and Cone
 - 22.3. 48", 60", and 72" Manhole Precast Base
 - 22.4. Manhole Adjusting Rings
 - 22.5. Manhole Lining System
 - 22.6. MAG Spec. ABC
 - 22.7. Precast Manhole Base Gasket System
 - 22.8. Manhole Joint Sealant
 - 22.9. Cast In Place Manhole Base Concrete
 - 22.10. Water Stop Gaskets
 - 22.11. Sewer Pipe Fittings
 - 22.12. Couplings
 - 22.13. Pipe Zone Material: ABC, #57 Rock, 1/2 Sack Slurry, 1 Sack Slurry
 - 22.14. Adjusting Ring Concrete
 - 22.15. Marker Balls
 - 22.16. Steel Casing
 - 22.17. Casing Spacers
 - 22.18. Casing End Seal
 - 22.19. Pipe Material

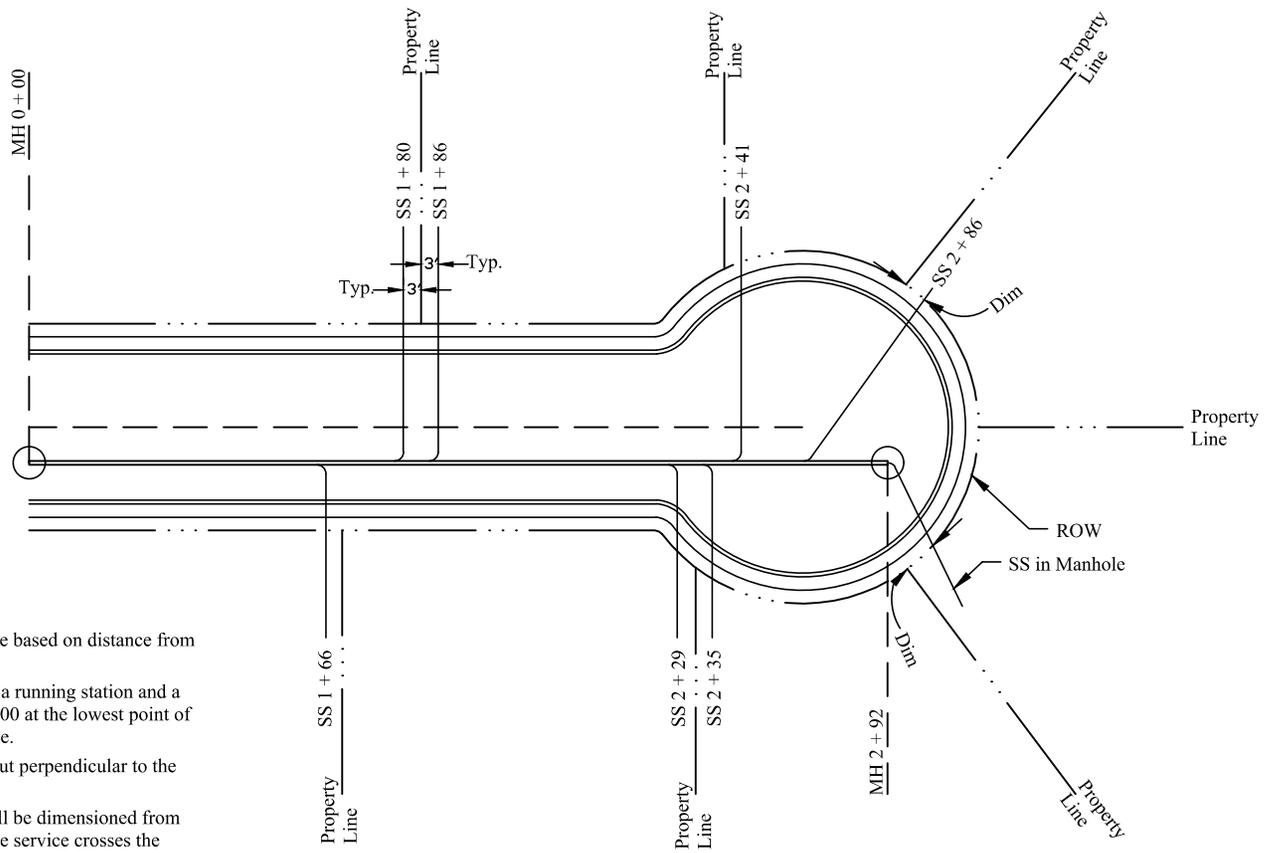


GENERAL NOTES

1. Sewer/water services locations shall be located by branding a "W" or "S" in the top of the curb.
2. The "W" or "S" shall be 4" in height. It shall have a minimum impression of $\frac{1}{4}$ ".
3. The brand shall be constructed of cast or machined lettering. Re-Bar is not allowed.
4. The impression of the brand must be within 6" of the actual service location.
5. The brand must be 1" from back of curb.

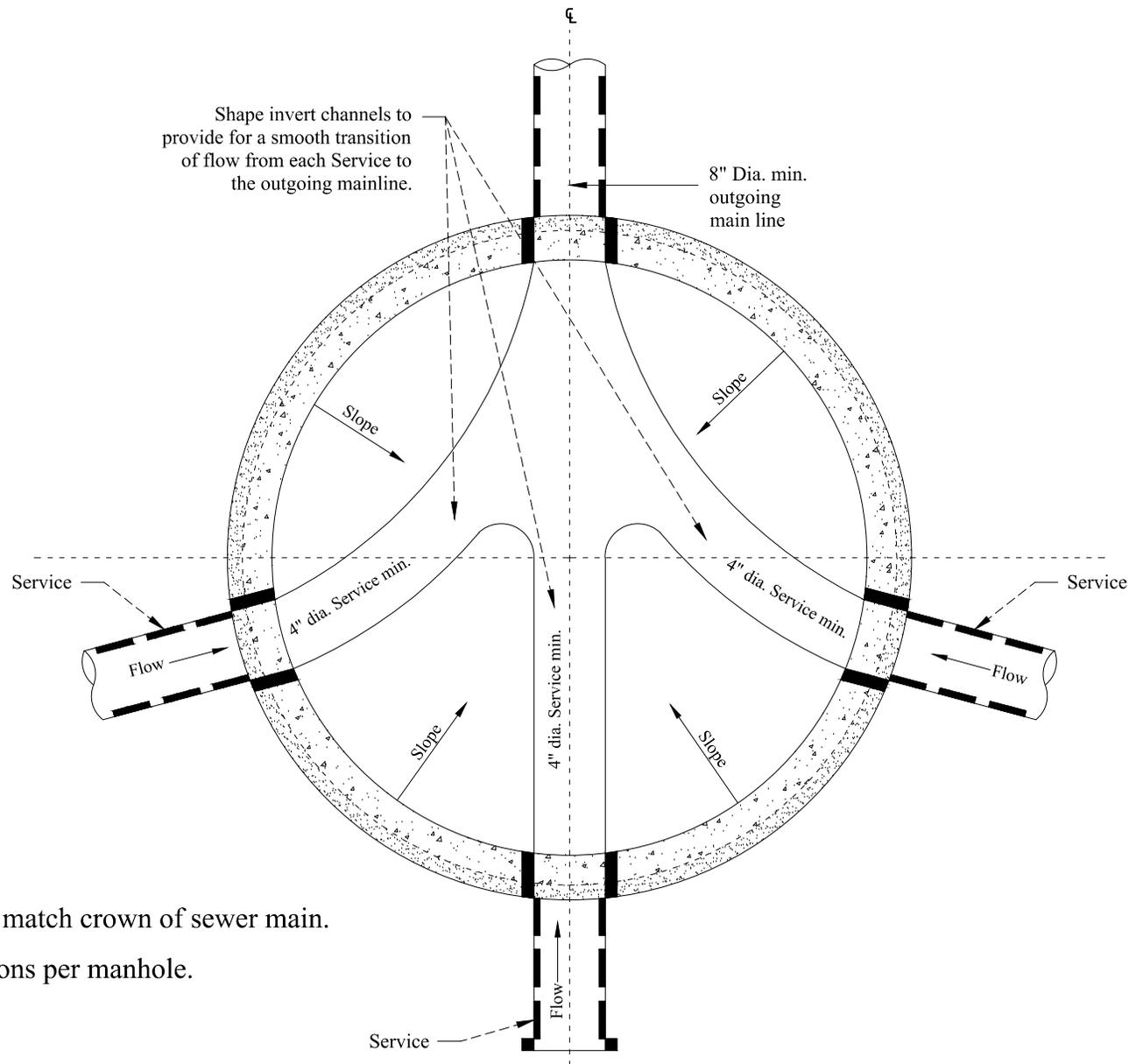


SERVICE BRAND DETAIL



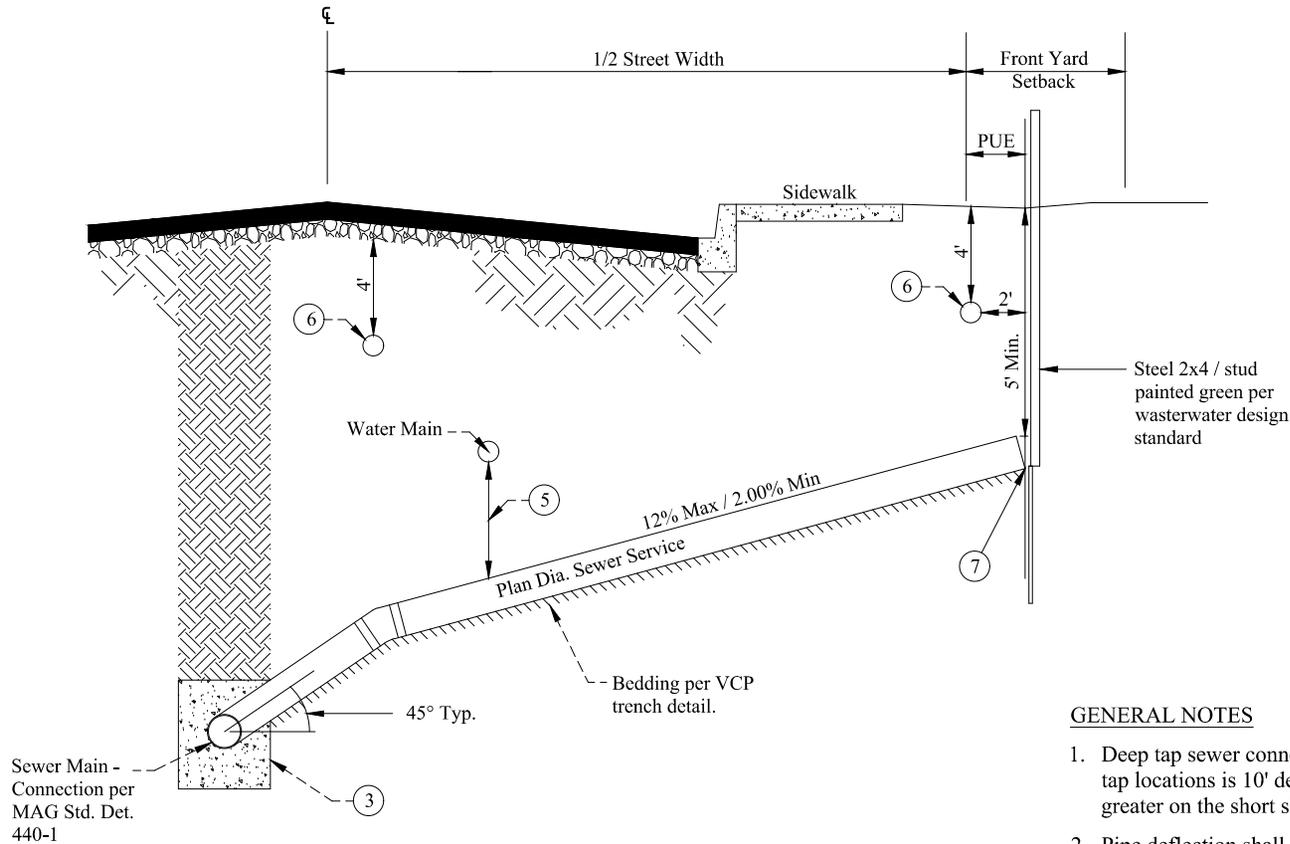
General Notes

1. Stationing for sewer services shall be based on distance from downstream manhole.
2. Sewer main stationing shall be both a running station and a sewer reach stationing starting at 0+00 at the lowest point of each reach, resetting at each manhole.
3. All service stationing shall be laid out perpendicular to the main.
4. Services angled toward lot lines shall be dimensioned from the nearest property line to where the service crosses the right-of-way line.
5. Mark the end of each service with a green 2x4 per wastewater design standard.
6. Standard service locations shall be 3' off the property line. Alternate locations may be in the center of the lot.
7. Brand service location on the curb per COB Detail 41220.



GENERAL NOTES

1. Flowline of service(s) to match crown of sewer main.
2. Maximum four penetrations per manhole.

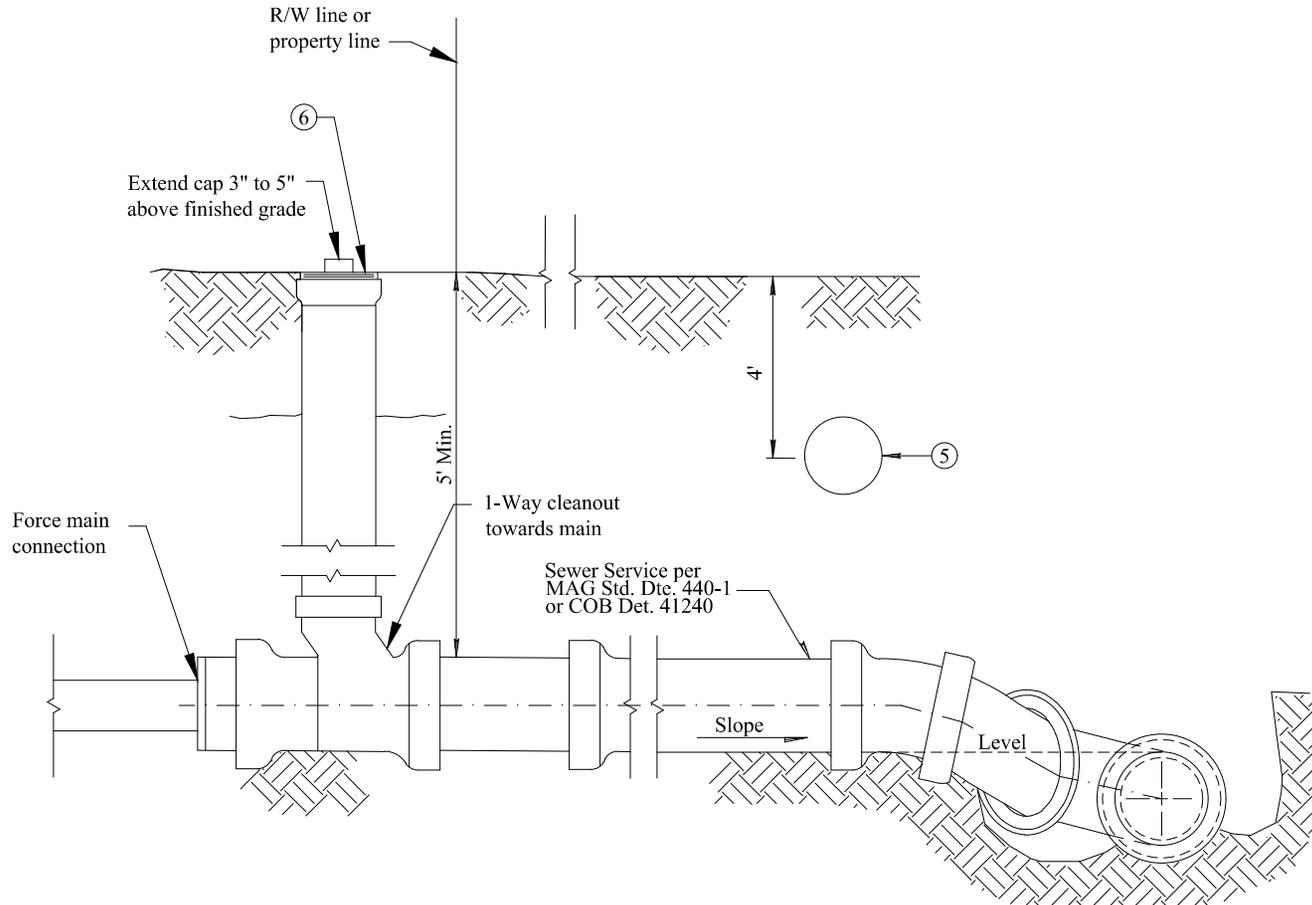


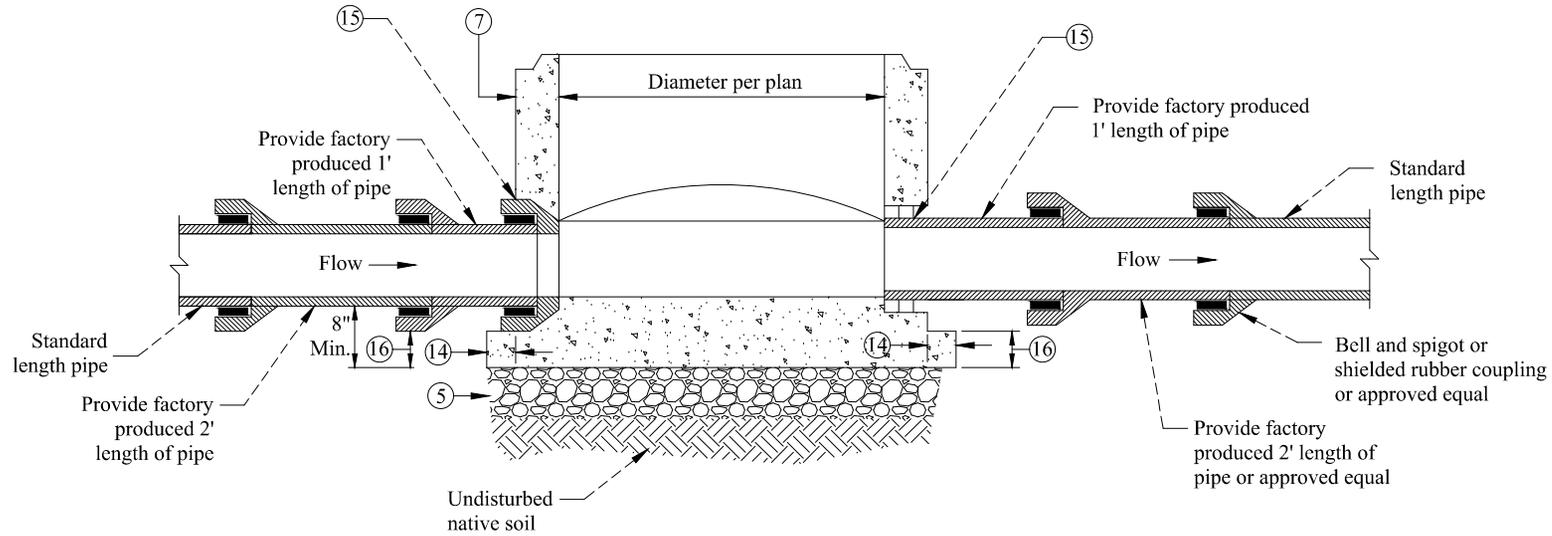
GENERAL NOTES

1. Deep tap sewer connections shall only be used when the main line at the tap locations is 10' deep or greater on the long side service, and 9' or greater on the short side service.
2. Pipe deflection shall not be allowed. Contractor must use factory fittings to achieve correct alignment, vertically or horizontally.
3. The service WYE shall be encased in slurry at the main. Encasement shall be a min. 3" around the service WYE. No field mixed slurry allowed.
4. Sewer service brand on the curb shall be per COB Detail 41220.
5. Provide a 1' minimum separation between water main and sewer service.
6. Electronic ball marker shall be a 3M Model 1424-XR/ID [4" diameter self leveling marker ball green in color] or approved equal or as required by COB.
7. End of tap to be sealed and marked.

General Notes:

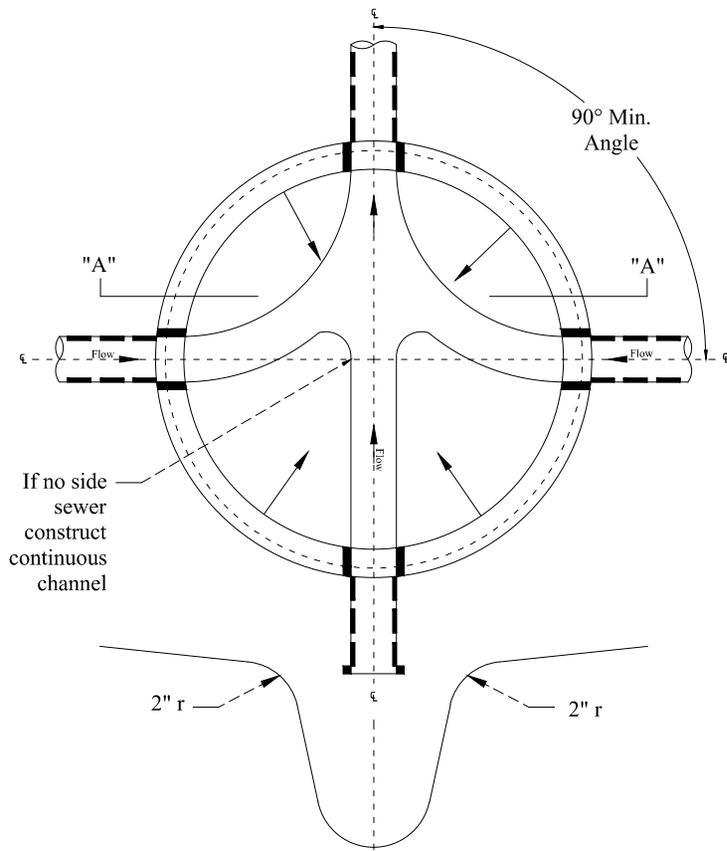
1. Residential Pressure Service Connection detail applies where pressure service ties into gravity service. Tap extends to property line in alleys or streets or to easement line.
2. For standard depth services use MAG Std detail 440-1. For deep tap services use COB 41240 Deep Sewer Service Detail.
3. All fittings shall be installed in accordance with ASTM D-2321. The contractor may vary from the drawing to use the appropriate WYES, TEE-WYES and bends to ensure no misalignment of the pipe and fittings. Block or brace fitting joints to ensure zero degrees angular joint deflection.
4. End of tap to be sealed and marked.
5. Electronic ball marker shall be a 3M Model 1424-XR/ID [4" diameter self leveling marker ball green in color] or approved equal or as required by COB.
6. Install raised 4" threaded plug in cleanout incorporating 3M model 1414 electronic disc marker. Green in color. Locator plug to be GPK products model #228-0004 DM or approved equal.
7. Brand Service location on the curb per COB Detail 41220.





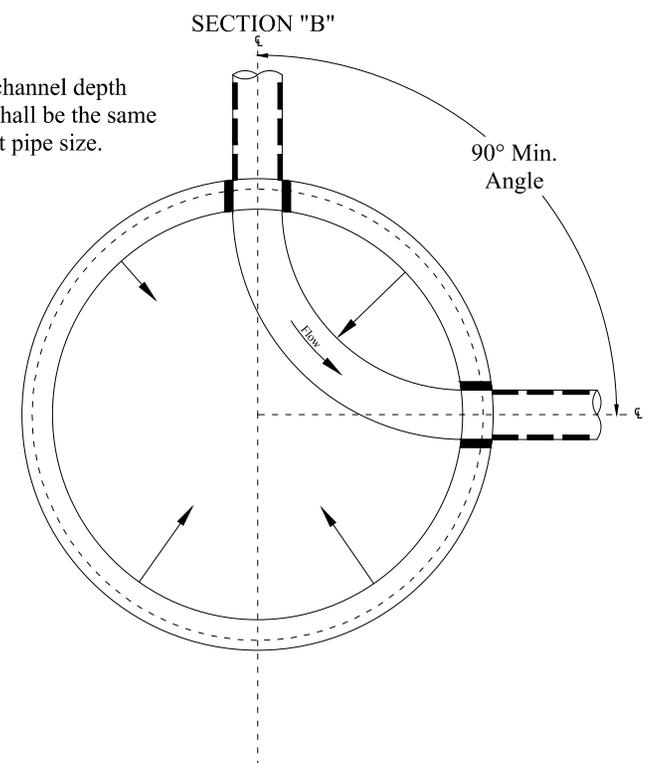
GENERAL NOTES

1. Pre-Cast manufacturer shall be an NPCA certified plant.
2. MAG "A" 4000 PSI concrete shall be used for manhole bases per ASTM C478.
3. Spring line of cast-in-place bell shall stop at inside face of manhole.
4. Joints for barrel section shall be tongue and groove or lap joint. All lifting holes shall be sealed with non metallic non-shrink grout.
5. All manhole bases shall be precast bases and shall be placed on 8" ABC compacted to 100% relative density.
6. The contractor is liable for all invert alignment and shall not make any field modifications to the base.
7. Minimum wall thickness shall be 1/12" of the largest diameter of the pre-cast manhole base plus 1".
8. Reinforcement shall be designed by structural engineer.
9. Channel width shall remain constant through the manhole base.
10. There shall be no hard connections (grouted) into the manhole base.
11. All sewer service connections shall have the same connection types into the pre-cast manhole base.
12. All core holes into this structural pre-cast base shall be coated with the City of Buckeye approved coating material. All cores require special approval.
13. Base shall be cast monolithically with the manhole sides.
14. The minimum anti-float ring shall be 6" wide on 48" bases, 7" wide on 60" bases, and 8" wide on 72" bases.
15. Cast in place VCP bell w/ polyurethane joint per ASTM standard C425, A-Lok, Z-Lok field gaskets, Cor-N-Seal rubber boot, or approved equal per ASTM C425.
16. Anti-Float ring shall be a minimum of 5" thick.

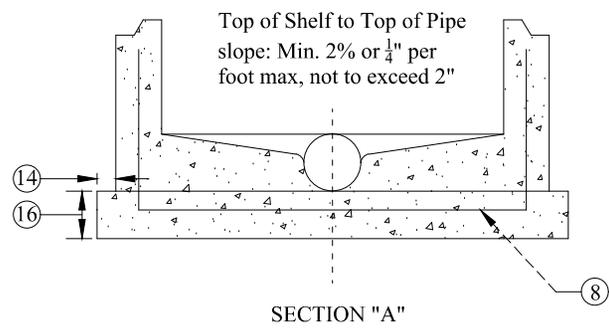


SECTION "A"

Minimum channel depth and width shall be the same as the outlet pipe size.



SECTION "B"



Top of Shelf to Top of Pipe
slope: Min. 2% or $\frac{1}{4}$ " per foot max, not to exceed 2"

SECTION "A"

41
250-2

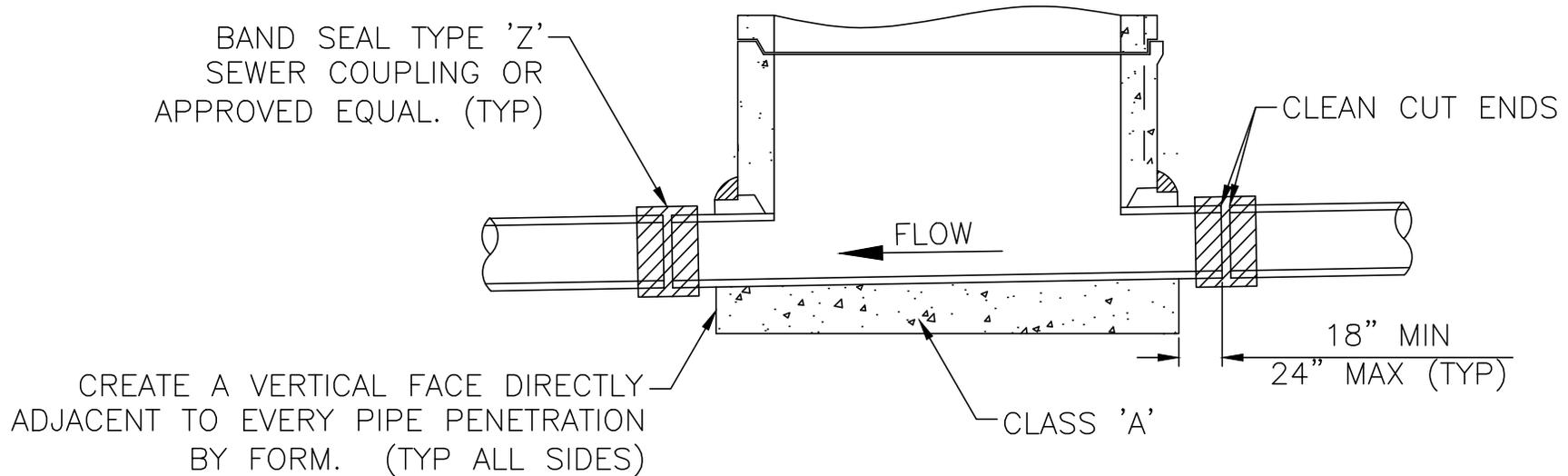


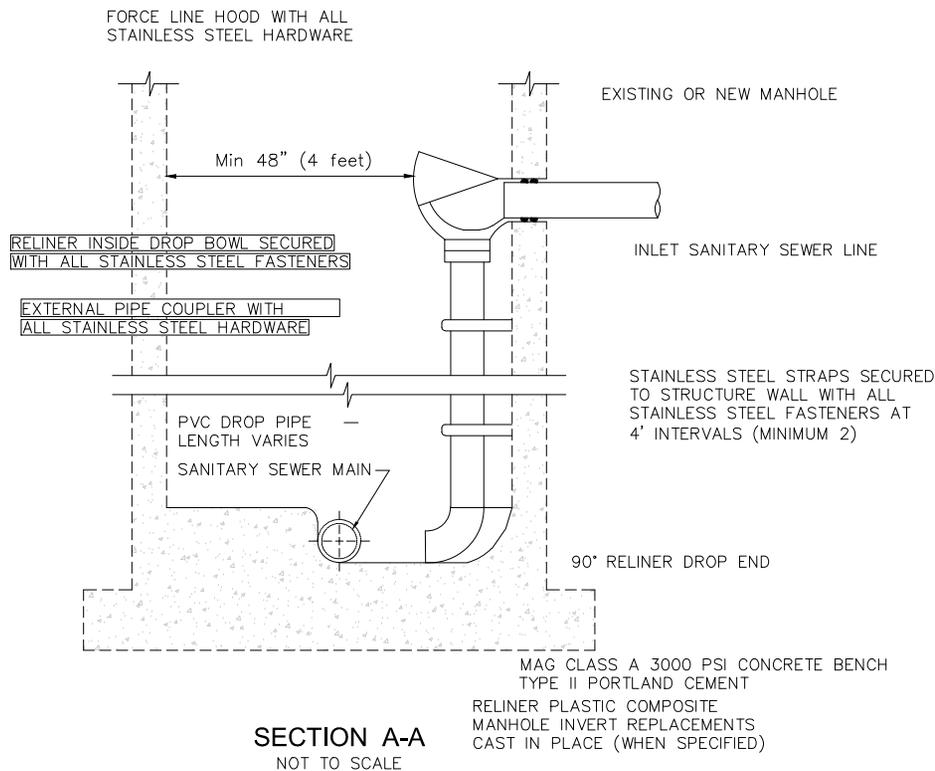
City of Buckeye
Standard Details

48", 60", OR 72" PRECAST MANHOLE BASE

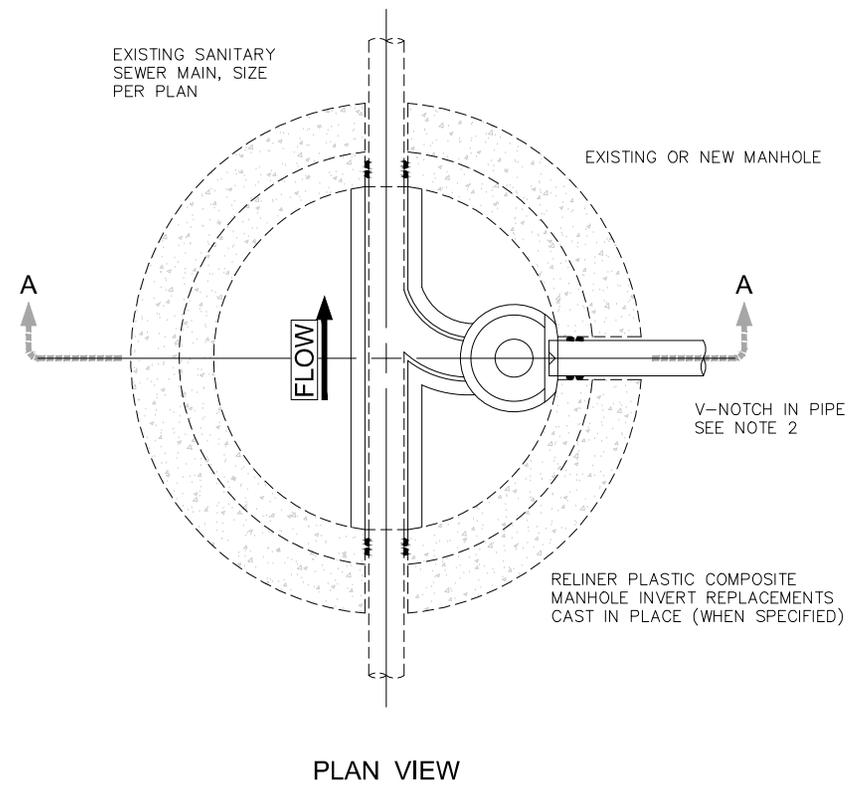
Revised: 07-07-20
Detail: 41250-2

- ① MAINTAIN CONSISTENT SLOPE THRU MANHOLE.
- ② SEWER COUPLING BY BAND SEAL TYPE 'Z' OR APPROVED EQUAL.
- ③ EVERY CONNECTION SHALL BE INSPECTED BY THE CITY.
- ④ STANDARD MANHOLE PER M.A.G. STD. DET. 420





SECTION A-A
NOT TO SCALE

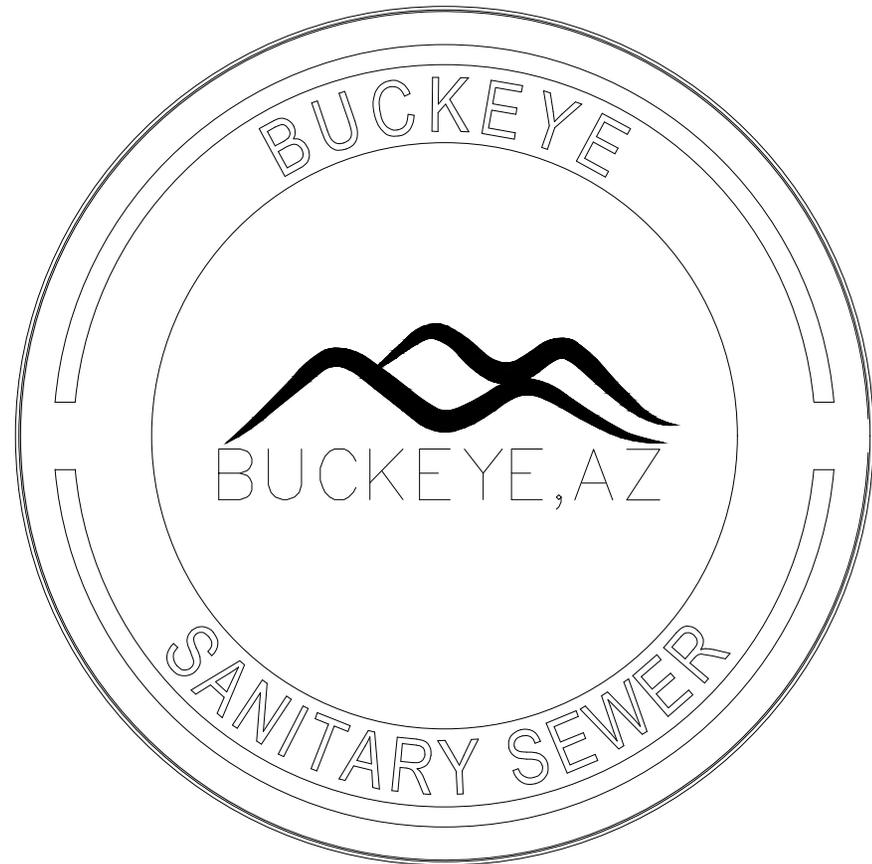


PLAN VIEW

- NOTES
1. CORED IN PLACE DROP CONNECTION SHALL UTILIZE KOR-N-SEAL I-WEDGE S-106 SERIES KORBAND FLEXIBLE PIPE TO MANHOLE CONNECTOR OR APPROVED EQUAL WITH ALL STAINLESS STEEL HARDWARE.
 2. INFLUENT LINE SHALL BE V-CUT AT THE FLOW LINE AND SMOOTH EDGE TO CONCENTRATE FLOW TO DROP BOWL / PIPE. EXTEND INFLUENT PIPE 3-5 INCHES INSIDE BOWL.
 3. ALL FERROUS MATERIAL SHALL BE 316 STAINLESS STEEL.
 4. INSIDE DROP LOCATION PER PLAN.



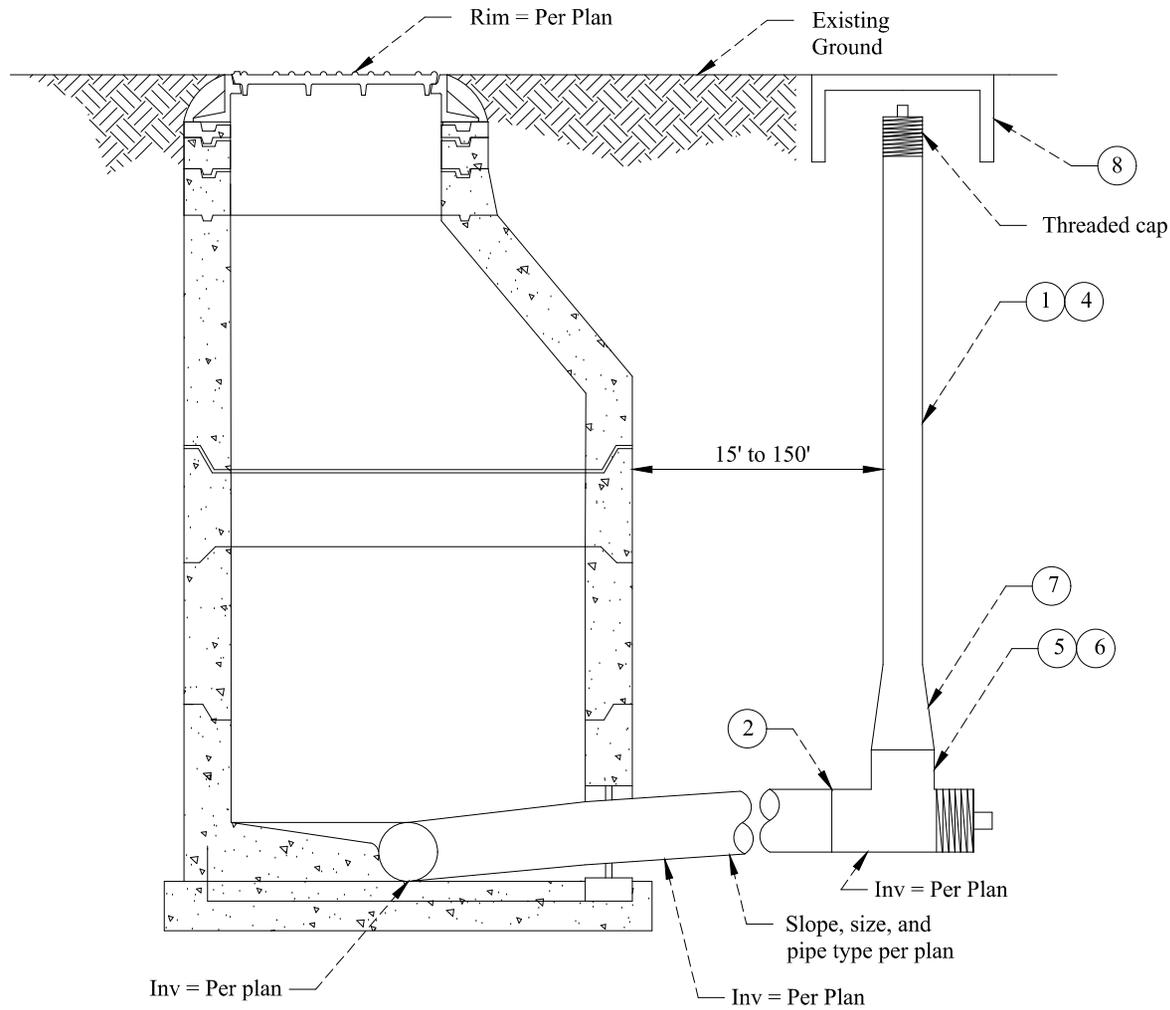
24"



30"

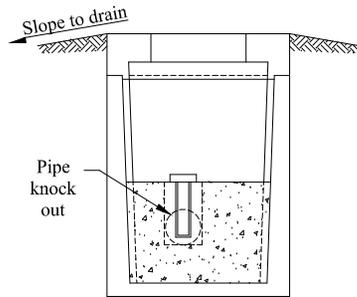
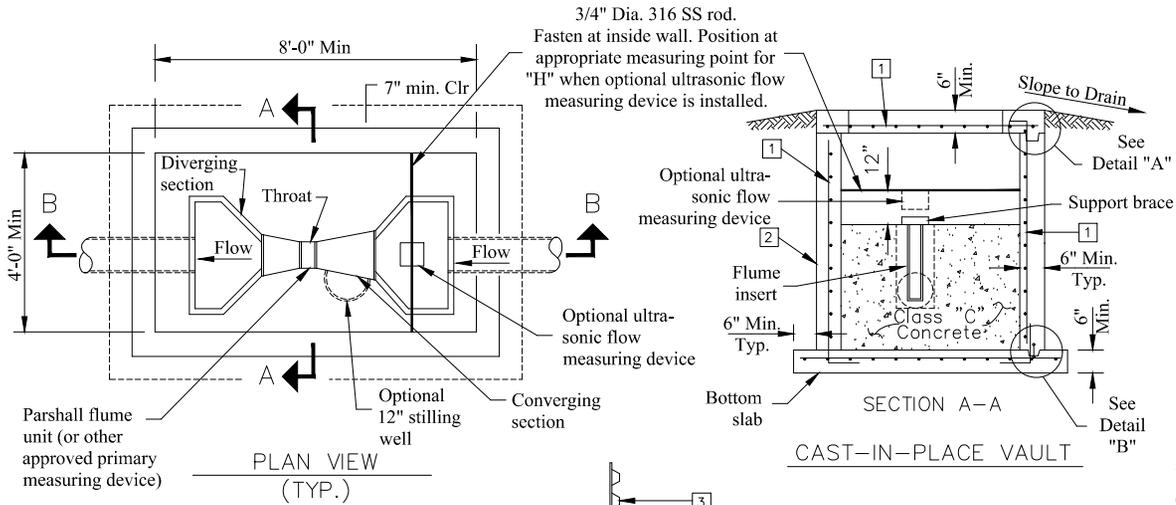
GENERAL NOTES

- 1. Covers shall be per MAG Std. Detail 423-1 and 423-2



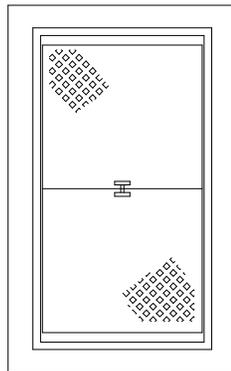
GENERAL NOTES

1. Temporary vertical pipe shall be 8" PVC SDR35.
2. Flexible couplings shall be used at all VCP to PVC transitions.
3. Pipe backfill shall be per vitrified clay pipe trench detail 41300.
4. The temporary vertical pipe shall be plumb.
5. "T" shall be removed when sewer is extended.
6. "T" to be clay or PVC with a permanent cap/plug on the end.
7. "T" shall be same size as main. Reduce to 8" vertically above the "T".
8. Install COB approved meter box marked "Sewer."

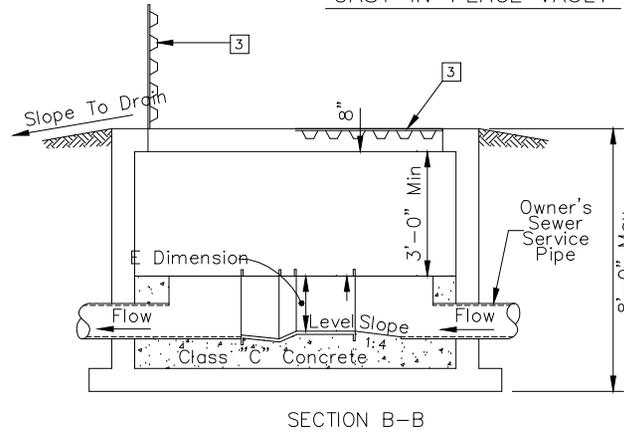


SECTION A-A
PRE-CAST VAULT

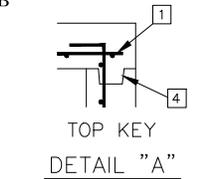
Utility Vault Co. vault no.
575-BL, no. 577-BL or
approved equal



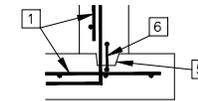
COVER WITH LID



SECTION B-B



TOP KEY
DETAIL "A"



BOTTOM KEY
DETAIL "B"

EQUIPMENT DESCRIPTION

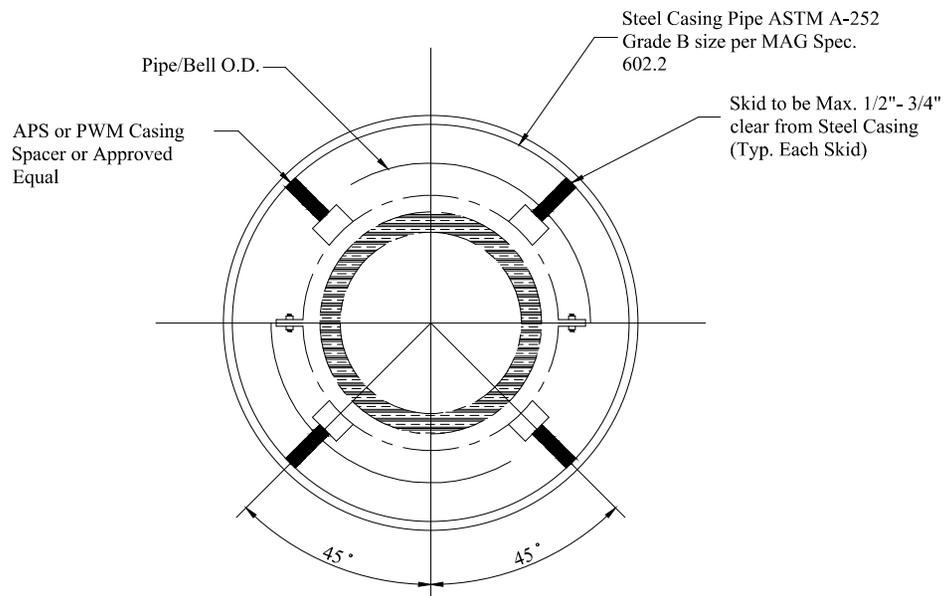
A Fisher and Porter type 10F1940, Hinde Engineering Company, PS-1001, or approved equal molded fiberglass reinforced polyester Parshall Flume shall be installed. The flume shall be molded in one piece with ample wall thickness and reinforcing ribs to prevent distortion during shipment, installation and operation. The flume shall be self-supporting and require no external supporting structure. Interior dimensions shall conform to those in the latest revision of Water Measurement Manual published by the U.S. Department of the Interior, Water and Power Resources Services. The throat width and flume height (*E dimension) shall be per plan.

General Notes:

1. All construction shall conform to MAG Specifications and Details, unless modified on the plans.
2. All concrete floors, walls and top slab of the structure shall conform to MAG section 725, Class A, minimum compressive strength at 28 days = 3,000 psi.
3. All concrete for the grout fillet inside the structure shall conform to MAG Section 725, Class C, minimum compressive strength at 28 days = 2,000 psi.
4. All steel reinforcing shall be deformed bars, Grade 60, billet steel conforming to ASTM Specification No. A-615, latest edition.
5. The Monitoring/Sampling Vault shall be installed on the owner's property in an access easement, as close to the customer tap to the City sewer as feasible, and approved by the City of Buckeye.
6. Flume size should be based upon the minimum and maximum flow rates and velocities to insure free-flow conditions.
 - Maximum Flow = 70%-100% of maximum capacity of selected flume size.
 - 0.5 inches of flow should exist at the minimum actual flow.
7. Flume floor elevation should be high enough, relative to downstream conditions, to prevent submerged flow (50% submergence is acceptable at maximum flow), Install the flume level (longitudinally and transversely) in the converging section.
8. Upstream flow should be wave free, non-turbulent, and symmetrical having a uniform velocity (1 fps minimum to 3 fps maximum) at least 10 times the diameter of the upstream sewer pipe in length in the approach channel. Bends upstream in the flume will NOT be allowed for a distance of 25 pipe diameters unless conditions in the approach section of the flume will not be adversely affected.
9. The flume shall be installed off-center and away from the access door to allow the maximum working space for City personnel.
10. It shall be the owner's responsibility to properly maintain the flume in accordance with the manufacturers recommendations to ensure the accuracy of the measurement.

Notes

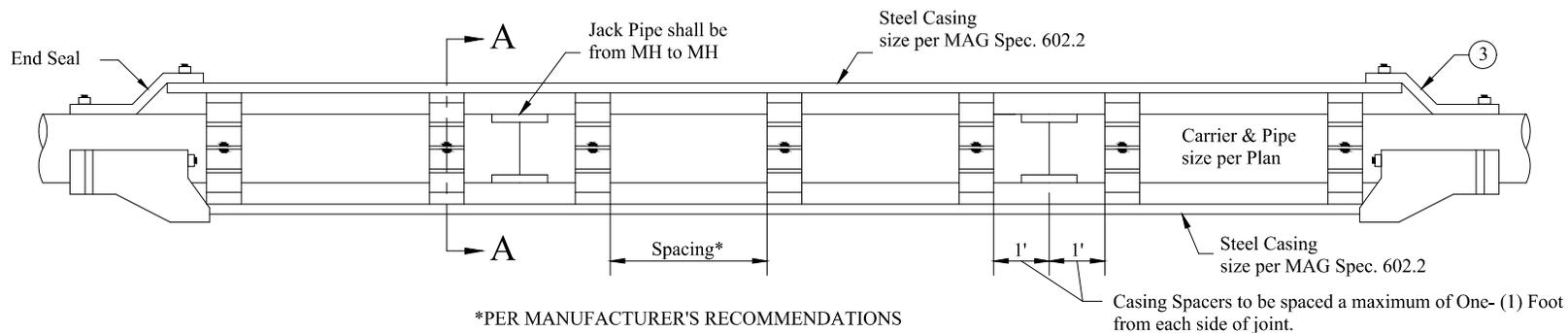
- 1 Reinforced steel and clearance as approved by the engineer.
- 2 All walls shall be designed by an Arizona certified Structural Engineer. Minimum wall thickness shall be 6".
- 3 2 (corrosion resistant) shock assisted door openers and galvanized diamond plate access doors (design loading AASHTO-H20) locking with type 316 SS hardware.
- 4 2"x 4" key, center on wall. (Install rope caulk continuously).
- 5 1-5/8"x 2-1/2"x 3" key.
- 6 4" PVC dumbbell type continuous waterstop 3/8" min. thickness. (Wash thoroughly prior to installation.
- 7 The interior of the structure shall have a protective coating per "Structure Coatings" section in the Wastewater Design Standards.
- 8 A ladder shall be furnished and installed in accordance with OSHA standards for type 1A fixed ladders. The ladder shall be fiberglass or 316 Stainless steel.

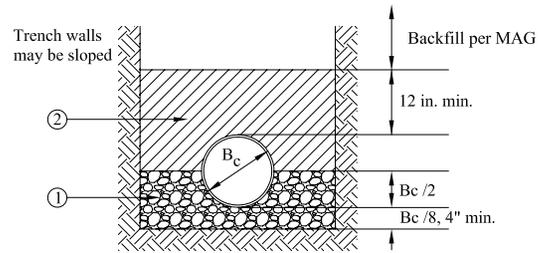


**CASING SPACER DETAIL
SECTION A-A**

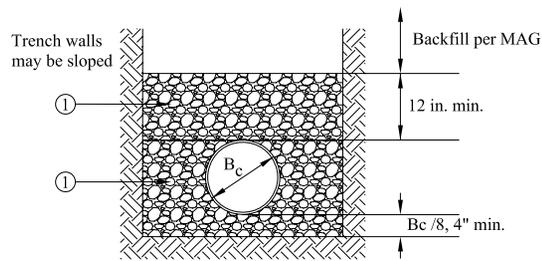
GENERAL NOTES

- ①. Installation to be in accordance with Manufacturer's Specifications.
- ②. Safety: Equipment Certification for installation of Casing / Carrier Pipe.
- ③. End seal to provide a water tight connection shall be approved by the COB.
- ④. APS or PWM injected molded Polyethylene Spacers, or approved equal.
- ⑤. Clay Jack Pipe bands shall be 316 stainless steel compression disc to distribute the jacking forces.

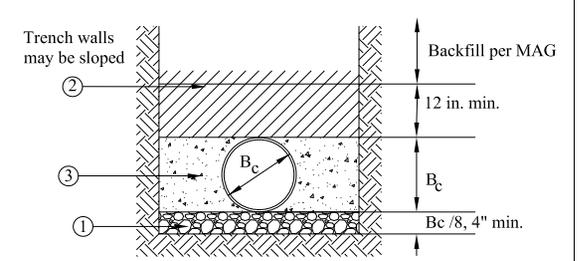




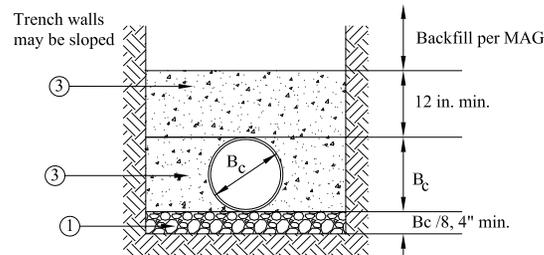
TYPE I



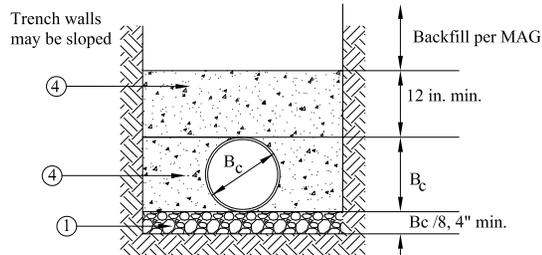
TYPE II



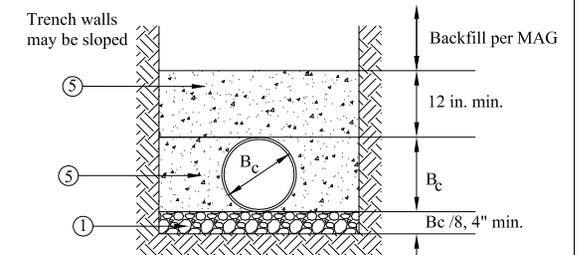
TYPE III



TYPE IV



TYPE V



TYPE VI

- ① #57 Crushed Stone or COB Approved Suitable Bedding Material or As Approved by the City.
- ② MAG ABC or COB Approved Selected Material or As Approved by the City.
- ③ 1/2 Sack Controlled low strength material (CLSM) per MAG Spec. 728.
- ④ 1 Sack Controlled low strength material (CLSM) per MAG Spec. 728.
- ⑤ 2 Sack Controlled Low strength material (CLSM) per MAG Spec. 728.

* B = Inside/Outside pipe diameter

Depth to top of Pipe (Feet)	Pipe Diameter (inches) (Minimum three edge bearing strength per ASTM C-700)												
	4 (2000 lbs/ft)	6 (2000 lbs/ft)	8 (2200 lbs/ft)	10 (2400 lbs/ft)	12 (2600 lbs/ft)	15 (2900 lbs/ft)	18 (3300 lbs/ft)	21 (3850 lbs/ft)	24 (4400 lbs/ft)	27 (4700 lbs/ft)	30 (5000 lbs/ft)	33 (5500 lbs/ft)	36 (6000 lbs/ft)
5	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I
6	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I
7	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I
8	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I
9	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I
10	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I
11	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I
12	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I
13	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I
14	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type II	Type II	Type II	Type II
15	Type I	Type I	Type I	Type I	Type I	Type I	Type II						
16	Type I	Type I	Type I	Type I	Type I	Type II	Type III	Type III	Type III				
17	Type I	Type I	Type I	Type I	Type I	Type II	Type II	Type III					
18	Type I	Type I	Type I	Type II	Type II	Type II	Type III						
19	Type I	Type I	Type I	Type II	Type II	Type III							
20	Type I	Type I	Type I	Type II	Type II	Type III							
21	Type I	Type I	Type I	Type III									
22	Type I	Type I	Type II	Type III	Type III	Type III							
23	Type I	Type I	Type II	Type III	Type III								
24	Type I	Type I	Type II	Type III	Type III								
25	Type II	Type II	Type II	Type III	Type III								
26	Type II	Type II	Type III										
27	Type II	Type II	Type III										
28	Type II	Type II	Type III										
29	Type III	Type III	Type III										
30	Type III	Type III	Type III										
31+	Type III	Type III	Type III										

Type IV



GENERAL NOTES (For all pipe sizes 4" to 78")

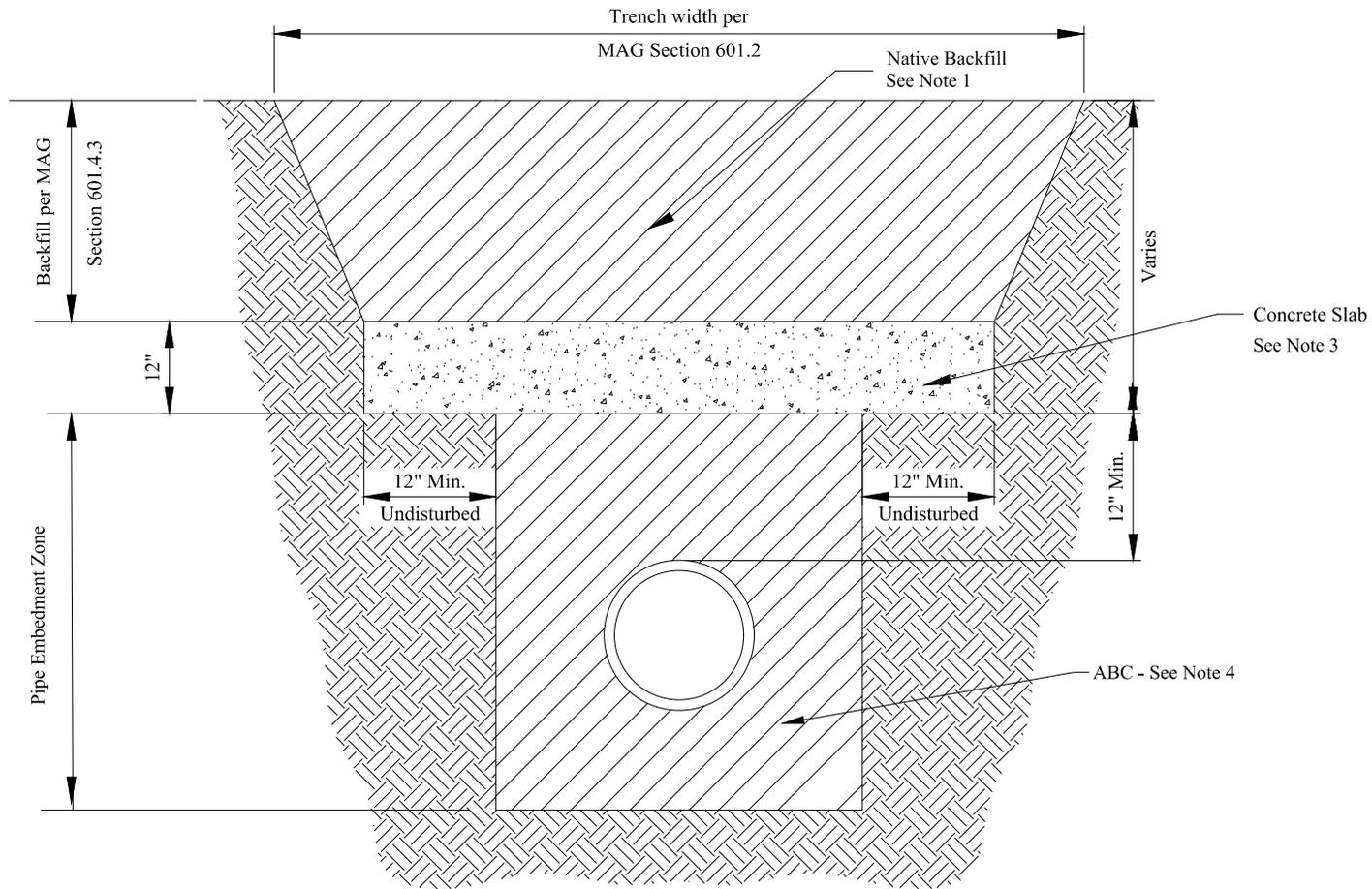
1. Suitable bedding material is #57 crushed stone per ASTM D448 to be used a minimum of Bc/8 or 4" below pipe and up to bedding class elevation.
2. 130 lbs / cu.ft. silty sand soil used in backfill load computations.
3. A minimum of 1.2 factor of safety was used to determine bedding class.
4. Project conditions and pipe diameters not meeting the above criteria shall be designed per ASTM C-12 Standard Practice for Installing Vitrified Clay Pipe Lines.
5. All Pipe with less than 5' of cover shall be Type IV trench detail.

Flexibile Sewer Pipe Trench Design

Large Diameter Pipe - 30" and Larger

Depth to top of Pipe (Feet)	Pipe Diameter (inches)								
	30	36	42	48	54	60	66	72	78
5	TYPE V	TYPE V	TYPE V	TYPE V	TYPE VI				
6	TYPE V	TYPE V	TYPE V	TYPE V	TYPE VI				
7	TYPE V	TYPE V	TYPE V	TYPE V	TYPE VI				
8	TYPE V	TYPE V	TYPE V	TYPE V	TYPE VI				
9	TYPE V	TYPE V	TYPE V	TYPE V	TYPE VI				
10	TYPE V	TYPE V	TYPE V	TYPE V	TYPE VI				
11	TYPE V	TYPE V	TYPE V	TYPE V	TYPE VI				
12	TYPE V	TYPE V	TYPE V	TYPE V	TYPE VI				
13	TYPE V	TYPE V	TYPE V	TYPE V	TYPE VI				
14	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI
15	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI
16	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI
17	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI
18	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI
19	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI
20	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI
21	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI
22	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI
23	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI
24	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI
25	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI	TYPE VI





GENERAL NOTES

1. Native material as described in MAG Section. 601.4.3.
2. All compaction densities: Type 1 as described in MAG Section 601.4.4.
3. Class "B" Concrete per MAG.
4. Pipe Embedment Zone shall be ABC per MAG 702.

RESOLUTION NO. 57-20

A RESOLUTION OF THE MAYOR AND CITY COUNCIL OF THE CITY OF BUCKEYE, ARIZONA, APPROVING AND ADOPTING THE JULY 7, 2020 GRAVITY SEWER ENGINEERING DESIGN STANDARDS; AND DECLARING AS A PUBLIC RECORD THAT CERTAIN DOCUMENT ENTITLED “CITY OF BUCKEYE GRAVITY SEWER ENGINEERING DESIGN STANDARDS” DATED JULY 7, 2020.

BE IT RESOLVED BY THE MAYOR AND CITY COUNCIL OF THE CITY OF BUCKEYE, ARIZONA, as follows:

WHEREAS, the City Code of the City of Buckeye, Arizona (the “City”), including the City Development Code, requires landowners and/or developers to design, construct, install and pay for and, until accepted by the City pursuant to City requirements, be responsible for the cost of operating, maintaining and repairing any and all facilities and appurtenances on-site and/or off-site, necessary to provide municipal wastewater treatment to the development or subdivision of the landowner and/or developer.

WHEREAS, in order to provide to the development community written City policy, design criteria and standards for designing, constructing and installing the required wastewater infrastructure to serve the water demands of the proposed development, the City Engineer prepared certain gravity sewer engineering design standards which were adopted by Mayor and City Council (formerly Town Council) on March 20, 2012 by adoption of Resolution No. 37-12.

WHEREAS, the City desires to modify and replace the gravity sewer engineering design standards adopted by Resolution No. 37-12.

NOW THEREFORE, BE IT RESOLVED BY THE MAYOR AND CITY COUNCIL OF THE CITY OF BUCKEYE, ARIZONA, as follows:

Section 1. The certain document entitled “City of Buckeye Gravity Sewer Engineering Design Standards,” dated July 7, 2020, of which at least three paper copies or one paper copy and one electronic copy are on file in the Office of the City Clerk and open for public inspection during normal business hours, is hereby declared to be a public record and said copies are ordered to remain on file with the City Clerk.

Section 2. The City of Buckeye Gravity Sewer Engineering Design Standards, dated July 7, 2020, are hereby approved and adopted, and the previous “Town of Buckeye Wastewater Design Standards-Gravity Sewer” adopted by Resolution No. 37-12 are hereby replaced by the City of Buckeye Gravity Sewer Engineering Design Standards approved and adopted by this Resolution No. 57-20.

Section 3. The Gravity Sewer Engineering Design Standards may be modified or revised from time to time by Mayor and City Council of the City of Buckeye; provided however, that the City Engineer is hereby authorized to make typographical or technical corrections to the

Gravity Sewer Engineering Design Standards, including corrections or improvements to maps, drawings, detail, and graphics of the Gravity Sewer Engineering Design Standards, that do not result in substantive changes to the Gravity Sewer Engineering Design Standards.

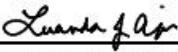
Section 4. The Mayor, the City Manager, the City Clerk, the City Attorney and the City Engineer are hereby authorized and directed to take all steps necessary to carry out the purpose and intent of this Resolution.

PASSED AND ADOPTED by the Mayor and City Council of the City of Buckeye, Arizona, this 7th day of July, 2020.



Jackie A. Meck, Mayor

ATTEST:



Lucinda J. Aja, Town Clerk

APPROVED AS TO FORM:

Shiela B. Schmidt

Shiela B. Schmidt, City Attorney