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MINIMUM DESIGN STANDARDS FOR SEWAGE COLLECTION AND RECLAIMED WATER DELIVERY SYSTEMS

Adopted August 2005
(Updated and reprinted March 2009)

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SECTION I – INTRODUCTION

A. PURPOSE OF DOCUMENT

1. Purpose. The purpose of this document is to provide minimum design standards utilized by the Arizona City Sanitary District for any extension, addition, improvement, repair, alteration or replacement to the District's publicly owned sewage collection facilities or to the portion of the sewage system owned by private parties that interconnects with the District's facilities. The District may require higher or different specifications for particular projects. The District reserves the right to alter, amend or rescind these design standards at any time. No deviation from District approved standards shall be permitted unless approved in writing by the District's Authorized Representative. **IT IS IMPORTANT THAT A DISTRICT PERMIT BE OBTAINED AND ALL PLANS SUBMITTED TO THE DISTRICT FOR REVIEW AND APPROVAL PRIOR TO COMMENCEMENT OF CONSTRUCTION.**

2. Scope. This document applies to existing systems being expanded, modified, upgraded and rehabilitated as well as to the construction of new facilities. However, this document is not intended to be used as a construction specification.

B. EFFECTIVE DATE

This document is adopted effective August 17, 2005. The administration of these minimum design standards including interpretation, enforcement, revision, waiver and variance is delegated to the Board of Directors of the Arizona City Sanitary District. This document and the standards contained herein shall supersede all former standards, details, policies and procedures of the Sanitary District which are in conflict herewith.

C. REVISIONS, AMENDMENTS OR ADDITIONS

This document may be revised and amended from time to time. Such revisions and amendments shall be binding and of full force and effect

after they have remained posted in a conspicuous public place in the business office of the Arizona City Sanitary District for a period of 15 calendar days.

D. ORGANIZATION AND INTERPRETATION

This document is composed of written engineering standards, references to established standards of other organizations and agencies. The interpretation of any section or of differences between sections shall be made by the Board of Directors whose interpretation shall be binding and controlling in its application.

E. QUALITY ASSURANCE

1. General. Unless otherwise noted herein, all facilities construction shall conform to the following:

   a. Uniform Standard Specifications for Public Works Construction, Maricopa Association of Governments, latest edition (MAG Standard Specifications and Details).

   b. Arizona Department of Environmental Quality, Engineering Bulletin No. 11.

   c. Arizona Administrative Code, Title 18, Chapter 9, latest edition.

   In all cases, the installation shall comply with, meet or exceed any applicable standard mandated by law, including without limitation the Clean Water Act and regulations promulgated by the Arizona Department of Environmental Quality.

F. DEFINITIONS AND TERMS

1. General. Whenever in this document the following terms are used the intent and meaning shall be interpreted as follows:

2. ADEQ. The Arizona Department of Environmental Quality.

3. Applicant. Person or persons making application for a permit to install a public sewage facility and shall be the owner of premises to be served by the sewer for which a permit is requested or his authorized agent.

4. Authorized Representative Means:

   a. For the District – the District Engineer, the Plant Supervisor or the Board of Directors.

   b. For the Customer/Landowner – The landowner and/or customer, persons with written authorization to act on behalf of the customer/landowner.

5. Backfill. Material placed in an excavated space to fill such space. For trenches, this space will be the area from one (1) foot above the top of the pipe or conduit to the existing or proposed finished grade of pavement.

6. Base Course. The upper course of the granular base of a pavement or the lower course of an asphaltic or portland cement concrete pavement structure.

7. Bedding. The material placed in the area from the bottom of the trench to one (1) foot above the top of the pipe or conduit.

8. Board of Directors. Board of Directors of the Arizona City Sanitary District.

9. Branch Sewer. A sewer that receives sewage from a relatively small area and discharges into a main sewer serving one or more branch sewer areas.

10. Building. Any structure built for the support, shelter, or enclosure of persons, animals, or movable property.

11. Building Code. A regulation establishing minimum standards of construction for the protection of the public health, safety, and welfare in terms of measured performance rather than in terms of rigid specification of materials and methods.

12. Building Connection. The sewer extension from a sewer tap on the public sewer to the property line or to the easement line of the property to be served. Also called Service Connection.

13. Building Sewer. That portion of any sewer beginning at the plumbing or drainage outlet of any building or industrial facility and running to the property line or to a private sewage disposal system.

14. Contractor. An individual, firm, corporation, partnership, or association duly licensed by the State of Arizona to perform the type of work to be done under a permit.

15. Developer. Any person engaged in the organizing and financing of an improvement or addition to a reclaimed water or sewage system forming a part of the Arizona City Sanitary District systems. A Developer may be a land owner, subdivider or legally constituted improvement district.

16. District. The Arizona City Sanitary District, Pinal County, Arizona, as established by the Arizona Revised Statutes.

17. Engineer. The Engineer appointed by and acting for the District and shall be a Registered Civil Engineer.

18. EPA. The United States Environmental Protection Agency.

19. Lateral Sewer. The portion of a sewer lying within a public street connecting a building sewer to the main sewer.

20. Main Sewer. A public sewer designated to accommodate more than one lateral sewer.

21. MAG. The Maricopa Association of Governments.

22. Manhole. A means of access to utilities such as sewer lines for the main purpose of inspection and cleaning.

23. Open Trench. The excavated area of construction until all the aggregate base course for pavement replacement has been placed and compacted or, if outside of a pavement area, until the excavated area is brought to finish or natural grade.

24. Outfall Sewer. A sewer that receives sewage from the collection system and conducts this discharge to the treatment works or a point of final discharge; also called Interceptor Sewer.

25. Pavement. Any street, alley, sidewalk, court, driveway or other transportation way surfacing consisting of mineral aggregate bound into a rigid or semi-rigid mass by a suitable binder such as, but not limited to, portland cement or asphalt cement.

26. Plans. All approved drawings or reproductions thereof pertaining to the work and details therefore.

27. Plumbing Code. The Uniform Plumbing Code of the International Association of Plumbing and Mechanical Officials.

28. Private Sewer. A sanitary sewer not controlled or maintained by the Arizona City Sanitary District.

29. Public Sewer. A sanitary sewer controlled and maintained by the Arizona City Sanitary District.

30. Reclaimed Water. Effluent which meets the standards for the specific reuses contained in ADEQ, Title 18, Chapter 9, Article 7.

31. Relief Sewer. A sewer built to carry the flows in excess of the capacity of an existing sewer.

32. Right-of-Way. A general term denoting land, property, or interest therein, usually in a strip acquired for or devoted to a street, highway, or other public improvement.

33. Sanitary Sewer. A sewer which carries sanitary sewage and to which storm, surface, and ground waters are not intentionally admitted.

34. Service Connection. See Building Connection

35. Sewage. A combination of water-carried wastes from residences, business buildings, public buildings, institutions and industrial establishments.

36. Sewer. A pipe or conduit for carrying sewage.

37. Sewer Tap. The wye, saddle or other device placed on a public sewer to receive a building connection.

38. Side Sewer. The sewer line beginning three feet outside the foundation wall of any building and terminating at the main sewer and including the building sewer and lateral sewer.

39. Submain Sewer. A sewer into which the wastewater from two or more lateral sewers is discharged and which subsequently discharges into a main, a trunk, or other collecting sewer.

40. Trunk Sewer. A sewer which serves as an outlet for a large contributing area; also called main sewer. In large systems, the principal sewer to which branch sewers and submain sewers are tributary. In small systems, a sewer to which one or more branch sewers are tributary. In plumbing, the public sewer to which the house or building sewer is connected.

41. Wastewater. The combination of the liquid and water-carried wastes from residences, commercial buildings, industrial plants, and institutions together with any inflow that may be present. See Sewage.

G. ABBREVIATIONS

The following is a list of primary abbreviations used in this document. All references to documents, manuals, standards or specifications or

other agencies or organizations (i.e. AWWA C400) refer to the latest edition or revision thereof unless specifically annotated to the contrary.

ADEQ	Arizona Department of Environmental Quality
ANSI	American National Standard Institute, Inc.
ARS	Arizona Revised Statutes
ASTM	American Society of Testing and Materials
AWWA	American Water Works Association
CO	Clean Out
DIP	Ductile Iron Pipe
FL	Flow Line
FLG	Flange
FPS	Feet Per Second
FT	Foot
GPM	Gallons Per Minute
ID	Inside Diameter
LF	Lineal Foot
MAG	Maricopa Association of Governments
MGD	Million Gallons Per Day
MH	Manhole
MJ	Mechanical Joint
NEC	National Electrical Code
NSF	National Sanitation Foundation
OD	Outside Diameter
OSHA	Occupational Safety and Health Administration
PSF	Pounds Per Square Foot
PSI	Pounds Per Square Inch
PVC	Polyvinyl Chloride Pipe
Q	Rate of Flow
ROW	Right-of-Way
RPM	Revolutions Per Minute
UL	Underwriters Laboratories Inc.
V	Velocity of Flow
YD	Yard

NOTE: Some of these abbreviations as used throughout this document may or may not be capitalized.

SECTION II – PREPARATION OF DETAILED CONSTRUCTION PLANS AND SPECIFICATIONS

A. GENERAL

Detailed construction plans and specifications shall be prepared and signed by a professional engineer who is qualified and registered by the State of Arizona in a particular field of competency required by the type of improvements.

B. BENCHMARK

All elevations shown on the plans shall be referenced to a benchmark on Arizona City Sanitary District Datum.

C. PRELIMINARY SEWER LAYOUT

1. General. Prior to the preparation and submittal of detailed construction plans and specifications, a preliminary sewer layout shall be prepared and submitted to the District for review and approval.

2. Purpose. The purpose of the preliminary sewer layout is to resolve the following issues:

    a. Where and how will the proposed development's sanitary sewer system connect to the existing public sewer system of the District?

    b. Will the entire development be serviced by gravity flow or will a pump station and force main be required for all or a portion of the new development?

    c. Are there any unique design considerations involved with the proposed sewer system?

    d. Is flow through capacity within the proposed system required? If so, to what degree and how will such flow through be accommodated?

e. Will the proposed sewer system require dedicated easements or additional right-of-way?

3. Sewer Layout Requirements. The preliminary sewer layout shall be shown on a plan incorporating the latest tentative plat for the proposed development. Surface contour elevations shall be shown on the plan. Where certain segments of the proposed sewer system are designated to provide flow-through capacity for upstream development, the developer will be required to extend the appropriate size sewer through to the boundary of the development in question.

a. Horizontal Alignment

- Changes in direction of the proposed sewer, incorporating acute angles shall be avoided.
- To the largest degree possible, all new public sewers shall be located within the right-of-way of the development's streets. In the event that this is not possible, the proposed sewer system shall be located within dedicated easements.
- The routing of sewers, within easements, in the interior of lots/parcels, shall be avoided.

b. Vertical Alignment

- The diameter and slope of gravity sewers to be installed shall be shown.
- The rim and invert elevations of the existing and proposed sewers at the point of connection shall be shown.
- The rim and invert elevations of the upstream terminal ends of any sewers designed to provide flow through capacity shall be shown.

- Affected existing sewers shall be identified by size and slope.

- The location of all proposed manholes and cleanouts shall be shown.

- The locations of pump stations and force mains, if required, shall be shown.

- At all points of extreme shallow cover and extreme depth of cover sufficient information shall be provided to clarify the situation.

c. Additional Information

- In the event pump stations and force mains are required, a tentative pump station layout shall be provided as well as the diameter, slope and type of pipe proposed for the force main.

4. Easement Requirements.

a. Eight (8) inch diameter sewers with eight feet or less of cover will require a sixteen foot wide easement. Unless otherwise approved by the District, the sewer shall be centered within the easement.

b. Wider easements will/may be required for larger and/or deeper sewer lines. The District reserves the right to establish the specific required width on a case by case basis. In general, the following easement widths will be required:

Diameter of Sewer Line	Easement Width
8"	16'
10" – 21"	20'
24" and Larger	30'

c. Any required easements for off-site public sanitary sewers shall be documented and recorded on separate instruments.

d. Easements required to accommodate flow through sewer reaches shall be extended through to the boundary of the involved development.

D. DETAILED PLANS AND SPECIFICATIONS

1. General. All detailed plans shall be prepared and submitted on 24-inch by 36-inch size sheets. The sheets shall be single plan and profile.

2. Scales. Vertical scale shall be 1" = 2' or 1" = 4'. Horizontal scale shall be 1" = 40' except for major streets and cases of unusual topography or complex situations, in which case the scale shall be 1" = 20'.

3. Utility Crossings. All sewer lines and utility crossings shall be shown in both plan and profile views.

4. Lettering. All lettering and symbols shall be 1/8" minimum so as to be legible when plans are reduced to half size.

5. Original Plans. Original plan sheets shall be submitted on 4-mil Mylar and be sufficiently clear to produce readable prints and copies. Electronic copies of the original plans shall be delivered to the District in Auto CAD 2002 format or latest Auto CAD version.

6. Specifications. All detailed specifications shall be submitted on 8-1/2 by 11 inch sheets with a minimum font size of 12. Final specifications shall be delivered to the District on diskette in Microsoft Word with one sealed unbound set.

7. Cover Sheet. Cover sheet shall contain the following, if applicable:

   a. Name of proposed development

b. Developer's name, address and telephone number
c. Engineer's name, address and telephone number
d. A vicinity or site location map
e. Spaces for approval signatures
f. Index of sheets
g. Estimated quantities

8. Second Sheet. Second sheet shall show key map and typical sewer notes.

a. Key Map. Key map shall be to an appropriate scale and indicate the following:

- All streets, alleys, easements, lots, splits and parcels. Streets shall be identified by name and lot parcels by number or letter as the case may be.
- All sewer lines with sizes, cleanouts and manholes shall be shown.
- Index of sheets indicated by single line with arrows indicating beginning and end of each sheet.
- Manholes shall be numbered consecutively and the numbers indicated.

b. Typical Sewer Notes. The following notes shall be shown, if applicable.

- All construction shall conform to the Uniform Standard Specifications for Public Works Construction, Maricopa Association of Governments latest edition, the Arizona Department of Environmental Quality Engineering Bulletin No. 11 and the requirements of the Arizona City Sanitary District, whichever is most stringent.
- Bedding material shall consist of granular material containing no pieces larger than 1 inch in size.

- All facilities, materials, and workmanship are subject to the approval and acceptance of the Sanitary District in order to assure the integrity of the District's collection system.

- Any work performed without the approval of the District and/or all work and materials not in conformance with the specifications is subject to removal and replacement at the Contractor's expense.

- Any deviation from the plans and specifications must be approved in writing by the Engineer and the Sanitary District prior to acceptance.

- The Contractor must obtain all necessary permits from the appropriate entities prior to construction. The Sanitary District shall be notified 24 hours prior to the different phases of construction for scheduling inspections.

- The Contractor shall uncover all existing lines being tied into to verify their location prior to trenching. The Contractor shall locate or have located all existing underground pipelines, telephone and electric conduits, and structures in advance of construction and shall observe all possible precautions to avoid damage to the same.

- Traffic control shall be maintained in accordance with all current county, state and federal regulations.

- Backfilling shall not be started until the Sanitary District representative approves all lines.

- The District representative shall determine the locations of the required compaction tests. The Contractor shall notify the testing lab, coordinate

with the inspector and testing lab, and pay the costs to perform the tests. Copies of test results shall be sent to the District Office.

- When a sewer line is adjacent to or crosses a potable water line special protection may be required to protect the water line from contamination by the sanitary sewer. Separation requirements and protection details shall be in accordance with MAG Standard Detail No. 404. A reclaimed water line shall be considered a potable water line when adjacent to or crossing a sanitary sewer line.

- All sewer service taps shall be constructed to the lot line or interior edge of the public utility easement, whichever is further onto the property. A plug or cap shall be installed at the end of each service tap with a 2x4 installed vertically and extending from the plug or cap to 2 feet above natural or finish grade. The 2x4 shall have #10 copper wire wrapped around it to aid in locating the tap in case the 2x4 is broken off at ground level. The 2x4 shall be Douglas fir, free of heart center, and pressure treated after fabrication with creosote. Redwood may be used as an alternate material. The 2x4 shall be painted green and the depth of the service (from grade to top of cap or plug) shall be painted on the 2x4. Metal 2x4's without wire are also acceptable.

- A District approved shut-off valve and valve box shall be installed at each tap installed or replaced after September 30, 2005. The District will provide the Elder Valve (see exhibit A) which is the approved shut off valve for 4" taps and the approved frame and cover that are to be installed on existing sewer mains. Frame and cover will be installed in accordance with MAG Detail 391-1 Type "A".

On all new sewer main construction after November 16, 2005, the developer will provide and install the Elder Valve, Frame and Cover. Elder Valves shall be as manufactured by Elder Valve, Inc. Meeker Co. Valve Boxes shall be as manufactured by Star Pipe Products, Standard Detail No. SD-300, labeled "SEWER" on lid.

- All sewer stubs shall end with a plug or cap and shall have a 2x4 installed vertically and extending from the end of the plug or cap to 2 feet above natural or finish grade. The 2x4 shall have #10 copper wire wrapped around it to aid in locating the stub in case the 2x4 is broken off at ground level. The 2x4 shall be Douglas fir, free of heart center, and pressure treated after fabrication with creosote. Redwood may be used as an alternate material. The 2x4 shall be painted green and the depth to the top of cap or plug shall be painted on the 2x4. Metal 2x4's without wire are also acceptable.

- All gravity sewer lines shall be low pressure air tested or hydrostatically tested for leakage in accordance with MAG Standard Specification Section 615. Manholes shall be constructed watertight with suitable waterstops provided at all manhole seams. The District's representative will witness all testing.

- Any previously tested sewer lines broken during the installation of other adjacent utilities shall be repaired and retested to the satisfaction of the Sanitary District.

- Acceptance of the completed improvements will not be given until photo Mylar reproducible "As Builts" (full and half size) have been submitted to and approved by the Sanitary District. Two (2)

printed sets of each (full and half size) shall also be submitted.

- Non-Shrink grout shall be used in the construction of all manholes.

- All sanitary sewer lines shall be polyvinyl chloride (PVC) pipe, unless otherwise noted. A certificate shall be furnished from the manufacturer attesting that the pipe meets the requirements of ASTM D 3034 SDR35.

- All cleanouts shall be constructed in accordance with the District's standard design and shall be maintained watertight.

- Compliance with all District, County, State and Federal rules and regulations pertaining to job safety shall be the responsibility of the Contractor.

- The inside of all new manholes shall be protected against corrosion by applying an epoxy liner system to the surfaces of the floors and walls. The below products have been approved for use when applied as directed by the manufacturer:
  - Sewer Shield Liner 100
  - Sauereisen Sewer Guard 210

- The inside of all new manholes shall be coated with insecticide paint in accordance with District requirements. Use either Insecta or Super IO, or approved equal. Application shall be in accordance with manufacturer's recommendations.

- Locator Wire - A green AWG No. 14 locator wire shall be installed above all gravity sewer and force mains between manholes. There shall be a minimum of 1 foot of separation between locator wire and detection tape. The locator wire shall terminate with a minimum of three (3) feet of a

coiled wire inside the manholes at each end of the sewer and in each Elder Valve box. Wire shall be neatly rolled with ends securely taped and hung in an out-of-the -way location. Wire is to be brought into manhole through a neat ¾ inch hole drilled through riser ring on top of taper a maximum of one (1) foot from the bottom of the casting. The ¾ inch hole shall be caulked with Sewer Shield® Caulk 101 or approved equal. Locator wire shall be taped to the top of all gravity sewers and force mains pipe at 3 foot intervals. All splices are to be tight and water proofed with 3M DBY Splice Kit No. 054007-09053 or approved equal. Acceptance of locator wire will be made at finish grade.

- Detection Tape - A green non-adhesive polyethylene continuous warning tape, 4 mil by 3 inches wide, shall be installed in the trench and centered over all gravity sewers and force mains between manholes at a depth of from 24 to 30 inches below finish grade. There shall be a minimum of 1 foot separation between locator wire and detection tape. The tape shall be Green and shall have the words, "CAUTION: SEWER LINE" or similar wording printed in black lettering continuously along the entire length. Lettering shall be a minimum 1 ½ inches high. Spacing between the individual words of the message shall not exceed three inches.

9. Plan and Profile Sheets. Each plan and profile sheet shall contain the following as a minimum:

- Job Title
- Sheet Number
- North Arrow
- Horizontal and vertical scale
- Existing utilities, with size and location in right-of-way
- Right-of-Way and lot lines

- Easement lines
- Sewer alignment and grade
- Manholes, cleanouts, wyes with sizes
- Existing ground profile over sewer
- Blue Stake stickers on each plan and profile sheet

E. RECORD DRAWINGS

Provide the Sanitary District with record information on the original final Mylar drawings indicating "as-built" conditions. Record information shall be added to final Mylar drawings in ink by hand.

SECTION III – SEWAGE COLLECTION SYSTEM

A. INTRODUCTION

1. General. This Section of the Standards sets forth minimum requirements for the design and construction of gravity sewer lines.

2. Contributory Flows. In general, gravity sewer lines shall be designed for the estimated population that will be contributory – present and future including adequate allowance for infiltration, institutional, commercial and industrial flows.

B. GRAVITY SEWER LINES

1. Design Flows. Average daily flows shall be calculated using the values shown in the following Table, unless directed otherwise by the District:

Type of Service	Average Daily Flow	Units
Domestic	100	gallons/person/day
Theater	5	gallons/seat/day
Retail	1	gallon/square foot/day
Restaurant	30	gallons/day/seat
Hotel/Motel	130	gallons/room/day
Schools (with lunch & shower facilities)	75	gallons/student/day
Schools (without lunch & shower facilities)	50	gallons/student/day
Other	100	gallons/person/day
Industrial & Commercial	1300	gallons/acre/day

Peak flow factors and an allowance for infiltration shall be as recommended in ADEQ Engineering Bulletin No. 11.

2. Sewer Sizing. Gravity sewer lines shall be sized to accommodate the peak design flows determined above, subject to the following limitations:

   a. Minimum sewer size shall be 8 inches in diameter.

   b. A maximum of 120 acres of combined commercial and residential development shall drain into an 8 inch diameter sewer.

   c. A maximum of 250 acres of combined commercial and residential development shall drain into a 10 inch diameter sewer.

   d. A maximum of 640 acres of combined commercial and residential development shall drain into a 12 inch diameter sewer.

   Pipe sizing calculations shall be made using the Manning Formula and an "n" value of 0.013. The Manning formula is typically expressed as:

$$V = \frac{1.486}{n}(R^{2/3})\,(S^{1/2})$$

   Where:

   V = mean velocity of flow, feet per second

   R = hydraulic radius, feet (flow area divided by wetted perimeter)

   S = slope of energy grade line, feet per foot

   n = coefficient of roughness

3. Depth of Cover. Gravity sewer lines shall be constructed at sufficient depths to serve the ultimate drainage area or as determined by the District's Master Plan and/or the District's Authorized Representative.

a. Cover At Wye Branches. Main line wye branches for service connections shall have a minimum cover of 6 feet.

b. Minimum Cover. Gravity sewer lines shall have a minimum cover of 4 feet. Lines shallower may be permitted under special approval, if constructed with lined ductile iron pipe and approved by the District.

4. Velocity Requirements. All gravity sewer lines shall be designed to provide a minimum velocity of 2.0 feet per second (fps) and a maximum velocity of 10.0 fps based on full flow and Manning's equation with a roughness coefficient "n" factor of 0.013 for all pipe materials. Minimum slope requirements for various sizes of sewer lines are shown in the following table:

Sewer Size	Minimum Slope To Maintain Velocity of 2 fps
8"	0.0033 ft/ft
10"	0.0024 ft/ft
12"	0.0019 ft/ft
15"	0.0014 ft/ft
18"	0.0011 ft/ft
21"	0.0009 ft/ft
24"	0.0008 ft/ft

5. Pipe Materials.

a. Pipe materials shall be one of the following:

- Ductile Iron Pipe – 3" through 20" – Centrifugally cast and conform to the requirements of ANSI/AWWA C151/A21.51 with a Pressure Class of not less than 250. Pipe shall be coated on the outside with an asphaltic coating in accordance with ANSI/AWWA C151/A21.51.

- Polyvinyl Chloride Pipe – 4" through 15" – ASTM D3034 with integral bell gasket joints and a standard dimension ratio of 35.

- Polyvinyl Chloride Pipe – 18" through 24" – ASTM F679 with integral bell gasket joints and a standard dimension ratio of 35.

- Pipe 27" and Larger – As directed by the District.

b. Affidavit of Compliance: Manufacturer shall furnish an affidavit that all delivered pipe materials comply with the requirements of the specified standards.

c. Pipe Joints:

- Ductile Iron Pipe. Push-on joints shall conform to ANSI/AWWA C111/A21.11 and shall include synthetic rubber gaskets and lubricant. Mechanical joint ends shall conform to ANSI/AWWA C111/A21.11 and shall include cast iron glands, synthetic rubber gaskets, and T-head bolts and nuts. Flanged ends shall conform to ANSI/AWWA C115/A21.15. Bolts and nuts for buried flanges shall be Type 316 stainless steel, ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts.

- Polyvinyl Chloride Pipe – Push-on joints shall conform to ASTM D3212 and shall include synthetic rubber gaskets and lubricants. Rubber gaskets shall be factory installed and conform to ASTM F477

d. Pipe Fittings:

- Ductile iron pipe fittings shall conform to ANSI/AWWA C110/A21.10 or C153/A21.53 with a minimum pressure rating of 250. Fittings shall

be coated on the outside with an asphaltic coating in accordance with ANSI/AWWA C151/A21.51. Push-on and mechanical joint ends including accessories shall conform to ANSI/AWWA C111/A21.11. Flanged ends shall conform to ANSI/AWWA C110/A21.10.

- Polyvinyl Chloride Pipe Fittings shall conform to ASTM D3034 for pipe sizes 4" through 15" and ASTM F477 for pipe sizes 18" through 24".

e. Pipe Couplings: When pipe of different materials and/or sizes are coupled together, Calder or Fernco type couplings with stainless steel bands shall be used.

f. Polyethylene Encasement: Polyethylene encasement shall be furnished and installed for protecting buried ductile iron pipe and fittings. Encasement shall be in accordance with MAG Standard Specification Section 610, Subsection 610.5.

g. Linings: Ductile iron pipe and fittings shall be shop lined on the interior with a 40 mil thick two component polyurethane material. Joint sockets and spigots shall be coated with a polyurethane or epoxy material compatible with the lining. Field cut ends and damaged areas shall be sealed and repaired as recommended by the manufacturer. Interior lining shall be Polythane, by U.S. Pipe, or an approved equal.

6. Sewer Alignment. All sanitary sewers shall be parallel to property lines or centerlines or as close to parallel as possible. Crossing and recrossing centerlines should be avoided, except in special cases approved by the District. Curvilinear sewers will not be permitted.

a. Horizontal Separation. The minimum horizontal distance from a sewer line to any parallel underground utility shall be 6 feet (outside diameters). A greater distance shall be used when required by the utility company.

b. Vertical Separation. When a sewer line crosses a potable water line, special protection may be required to protect the water line from contamination by the sanitary sewer. Separation requirements and protection details shall be in accordance with MAG Standard Detail No. 404.

c. Easements. Sewer lines shall not be placed in less than a 16 foot easement with at least an 8 foot wide easement on the sewer side of the property line. The easement shall permit access by District personnel and equipment to perform all operation and maintenance on the facilities within.

7. Manholes. All manholes shall be constructed with a cast-in-place concrete base, pre-cast reinforced concrete shaft sections and a Type A top in accordance with MAG Standard Detail No. 420. Alternate base with knockouts for pipes in shaft section will not be permitted by the District. A Romac Style "LCT" manhole adapter gasket shall be used on all PVC inlet and outlet pipes. All manholes will be provided with an inner lid inflow shield. Maximum manhole spacing for all sizes of sewer lines shall be 400 feet.

a. Manhole Locations. Manholes shall be located as follows:

- At all changes in pipe size
- At all changes in grade
- At all changes in horizontal alignment
- At all connections to private sewers
- At all lateral connections serving eight or more housing units
- At all lateral connections from certain commercial buildings (At District representative's discretion).

Manholes required at subdivision boundaries shall have stubs with shaped inverts in appropriate directions for future connections. Stub-outs shall be in accordance with MAG Standard Detail No. 427.

Manhole locations in washes, drainage ditches, channels or areas in direct path of surface runoff or ponding shall be avoided unless approved by the District. If approved, manhole top shall be a minimum of 6 inches and not more than 24 inches above natural grade. Seal-tite or approved bolt down manhole frames and covers approved by the District, shall be used.

b. Manhole Diameters. Manhole inside diameters shall be 5 feet or 4 feet depending upon sewer size and manhole depth as shown in the following table:

Sewer Size	Manhole Depth	Required Manhole Diameter
8" & 10"	Less than 10'	4'
	10' or greater	5'
8" & 10" (with more than one inlet)		5'
12" thru 24"		5'
Over 24"		Special Design

Five foot and four foot diameter manholes shall have 30 inch and 24 inch diameter frames and covers respectfully. Manhole frames and covers shall be in accordance with MAG Standard Detail No. 424.

c. Vertical Alignment. Manholes having lines intersecting at angles less than 22-1/2 degrees shall have a minimum of 0.10 feet of fall across the manhole. Manholes having lines intersecting at 22-1/2 degrees to 45 degrees shall have a minimum of 0.20 feet of fall across the manhole. Manholes having lines intersecting at more than 45 degrees to 90 degrees shall have a minimum of 0.30 feet of fall across the manhole. When lines of differing size enter a manhole, the upstream pipe shall not have its crown lower than the crown of the downstream pipe. When special cases require a drop connection, it shall be constructed in accordance with MAG Standard Detail No. 426. The maximum velocity generated at the entrance to a drop manhole connection shall be no greater than 6 fps.

d. Manhole Construction. Manhole construction shall be in accordance with MAG Standard Specification Section 625. Manhole steps shall not be installed in manholes. Ram-nek or approved equal shall be used between manhole shaft sections and between the base and first section. All joints shall be grouted inside and outside. Grout used in manhole construction shall be non-shrink type equivalent to the following:

- Gifford-Hill, "Supreme"
- L&M, "Crystex"
- Master Builders, "Masterflow 713 Grout"
- U.S. Grout, "Five Star Grout"

Sewer taps in manholes, if approved by the District, shall be constructed with the tap invert matching the crown of the downstream pipe.

e. Corrosion Protection – The inside of all new manholes shall be protected against corrosion by applying an epoxy liner system to the surfaces of the floor and walls. The below products have been approved for use when applied as directed by the manufacturer:
    - Sewer Shield Liner 100
    - Sauereisen Sewer Guard 210

Surfaces shall be prepared by abrasive blasting or shot blasting as recommended by the manufacturer.

f. Raising Manholes To Finished Grade. In unfinished easements, manhole frames and covers shall be 4-inches above natural grade.

- Any damaged grade rings shall be replaced
- Grout work is required at all joints and shall be free from cracks
- A trowel and brush finish of Sewer Shield shall be required

- ➢ Where grade rings cannot be used, bricks are acceptable but must be mortared in and coated with a trowel and brush finish of Sewer Shield. No voids will be permitted.

g. Manhole Coating. Inside of all new manholes shall be coated with insecticide paint using either "Insecta" or "Super IQ". Application shall be in accordance with manufacturer's recommendations.

8. Cleanouts. Cleanouts shall be constructed in accordance with MAG Standard Detail No. 441. A cleanout shall be installed at the end of a line if the line will not be extended in the future. The length from the last manhole to the cleanout shall not exceed 150 feet. If the length is more than 150 feet from the last manhole, then a manhole shall be installed at the end of the line instead of the cleanout.

9. Sewer Service Taps. On all new sewer line construction, in-line wyes shall be used instead of saddles for constructing sewer taps. The District in certain situations may approve deviations. The sewer tap shall be constructed from the main line to the lot line or interior edge of the public utility easement whichever is further onto the property. Taps shall not be made on 15 inch and larger sewers without special permission from the District. Building sewers larger than 4" may require a manhole connection to the public sewer as directed by the District.

a. Material: Sewer service taps 4 inch and 6 inch diameter shall be polyvinyl chloride pipe in accordance with ASTM D3034, SDR35. However, service taps installed under retaining walls shall be constructed of lined ductile iron pipe.

b. Service Tap Sizes. Minimum service tap sizes shall be as follows:

Type	Tap Size
Residential	4"
Multi-Family	6"
Commercial	6"

Industrial	6"

c. Shut-Off Valve and Box. On existing sewer mains where sewer services are installed, a District approved shut-off valve and box shall be installed in each sewer service tap constructed after September 30, 2005. The valve shall be located at the lot line or the public utility easement line whichever is further onto the property. If under special conditions, the shut-off valve and box cannot be installed at the property or easement line, the contractor will contact the ACSD and an approved alternate location will be selected.

On all new sewer main construction, after November 16, 2005, the shut-off valve and cover will be installed three (3) foot inside the right-of-way line or easement line.

d. Service Tap Marker. A plug or cap shall be installed at the end of each service tap with a 2x4 wood marker installed vertically from the plug or cap to 2 feet above natural or finish grade. The marker shall be wrapped with #10 copper wire to aid in locating the sewer service tap in case the 2X4 is broken off at ground level. The 2x4 shall be Douglas fir, free of heart center and pressure treated after fabrication with creosote. Redwood may be used as an alternate material. The 2x4 shall be painted green and the depth of service (from grade to top of cap or plug) shall be painted on the 2x4. Metal 2x4's without wire are also acceptable.

e. Sewer Tap Locations. Proposed tap locations shall be shown on all plans but may be changed in the field if approved by the District with changes being shown on final record "as-built" drawings.

10. Private Sewers. Sewer designs for private subdivisions and buildings shall be to District standards.

a. The landowner/customer is responsible for the operation and maintenance of all lines, pumps, valves, equipment and other appurtenances including the tap used to convey sewage to the District owned lines. The District's O&M responsibilities cease at the connection to the District's main line, which shall be made with a manhole.

b. The District shall not be responsible for the operation or maintenance of any private sewer.

11. Building Sewers. The connection of the building sewer into the public sewer shall be made gas tight and water tight. Building sewers shall conform to the requirements of applicable building and plumbing codes or other applicable rules and regulations of the district. Whenever possible the building sewer shall be brought to the building at an elevation below the basement floor. In all buildings in which any building drain is too low to permit gravity flow to the public sewer, sanitary sewage carried by such building drain shall be lifted by artificial means, approved by the Board and discharged to the public sewer at the expense of the Owner.

a. Size. No more than 150 fixture units shall be connected to a 4-inch building or side sewer.

b. Testing. All building sewers and lateral sewers shall be air or water tested and inspected for excessive leakage. Sewers showing excessive leakage shall be repaired or replaced at the expense of the Owner to the satisfaction of the District's representative.

12. Connection To Existing Public Sewer. The connection of the building sewer to the public sewer shall be made at the existing wye branch. However in the Series No. 1 Assessment District, if a wye branch is not properly located or available for the building sewer, a neat hole may be cut into the public sewer with entry into the downstream direction at an angle of 45 degrees. A wye saddle shall be used for the connection, epoxied into place, secured with stainless steel bands and encased in concrete. In no case shall the building sewer

protrude into the public sewer. The invert of the building sewer at the point of connection shall be at a higher elevation than the invert of the public sewer.

The connection described above applies only to the public sewers in Series No. 1 Assessment District. In all other Series "As-Built" drawings are available at the District office that show the location of existing service taps or wye branches.

Connections to the public sewer shall be made in the presence of District representative and under his supervision and direction. Any damage to the public sewer shall be repaired to the satisfaction of the Board at the cost of the applicant.

C. INSTALLATION

1. General. Except as otherwise required in this Section of the Standards, trench excavation, backfilling, compaction and installation of gravity sewer lines shall be in accordance with MAG Standard Specification Sections 601 and 615.

2. Trench Widths. Adhere to maximum trench width at top of pipe as defined in Table 601-1 of MAG Standard Specification Section 601. Additional load carrying capacity will be required if specified trench width is exceeded. Refer to and comply with OSHA Standards For Worker Protection.

3. Pipe Laying. Pipe shall be laid with a uniform bearing under the full length of the barrel. The pipe shall be assembled and joined in accordance with the manufacturer's instructions.

4. Bedding Material. That portion of the trench backfill from 4 inches below the bottom of the pipe to 12 inches above the top of pipe shall be backfilled uniformly on each side of the pipe with a bedding material conforming to MAG Standard Specification 601, Subsection 601.4.2 and 601.4.6. Compaction density shall be a minimum of 90 percent.

5. Backfill. Backfill shall be sound earthen material free from broken concrete, broken pavement, wood or other deleterious

material. Unless otherwise directed, this may be screened native material with no piece larger than 4 inches, select material, or aggregate base material. Compaction density shall be a minimum of 90 percent, unless the backfill is placed around utilities exposed during trench excavation, in which case the compaction density shall be a minimum of 95 percent. Backfill under street pavement shall be constructed per MAG Standard Detail 200, unless directed otherwise by the District. Water settling (jetting) of trench backfill with not be permitted.

6. Pavement Replacement. Existing pavement cut by trenching operations shall be replaced in accordance with MAG Standard Detail No. 200, unless directed otherwise by the District.

7. Ditch Crossing. When a sewer line crosses an irrigation ditch, there shall be at least 4 feet of cover between the flow line of the ditch and the crown of the sewer. If this condition cannot be met due to other obstacles, a concrete encasement shall be constructed around the sewer line. This encasement shall extend not less than 2 feet on either side of the sewer and extend not less than 1 foot on the top and bottom of the sewer. The encasement shall extend a minimum of 5 feet beyond the top of the side slopes of the ditch.

8. Separation. When a sewer line is adjacent to or crosses a potable water line special protection may be required to protect the water line from contamination by the sanitary sewer. Separation requirements and protection details shall be in accordance with MAG Standard Detail No. 404. A reclaimed water line shall be considered a potable water line when adjacent to or crossing a sanitary sewer.

9. Compaction Testing (Quality Assurance Acceptance Testing). Maximum density, gradation and PI tests will be performed on each type of material used for trench backfill. One compaction test will be performed on every foot of fill placed per 400 feet of trench, or between manholes, whichever is less. Pipe bedding material have a gradation and PI test performed for every 400 cyd per source used. One compaction test will be performed per 400 feet of bedding placed. All Compaction

failures will be re-tested using a Sandcone. Any resulting failure will be re-worked before any re-tests are performed. If a Nuclear Gauge is used for testing, it shall be calibrated against the Sandcone at least every ten test. Rock correction shall be used for any + #4 material to obtain Max Proctor Density. If the number of failed tests becomes excessive, the frequency of tests may be increased to ensure compliance with the specifications.

10. Leakage Testing. All gravity sewer lines shall be low pressure air tested or hydrostatically tested for leakage in accordance with MAG Standard Specification Section 615. Manholes shall be constructed watertight with suitable water stops provided at all manhole seams.

11. Deflection Testing. All PVC sewer pipe shall be deflection tested in accordance with MAG Standard Specification Section 615 with a rigid, non-adjustable 9-leg (minimum) mandrel having an effective length not less than its nominal diameter. Deflection shall not exceed 5 percent of the nominal inside diameter of the pipe.

12. Television Inspection. All new gravity sewer lines shall be televised. Any defects in materials or workmanship observed shall be corrected. No standing water or reverse grades will be permitted. The Contractor shall be responsible for the cost of this inspection and for any repairs that are necessary.

13. Sewer Cleaning. Prior to final inspection, all gravity sewer lines shall be cleaned by the Contractor with a hydrovac.

SECTION IV – SEWAGE PUMP STATIONS AND FORCE MAINS

A. INTRODUCTION

1. General. Sewage pump stations shall only be incorporated into the sewage collection system after conceptual approval by the District.

2. Site Selection. In selecting a site for a raw sewage pump station consideration shall be given to the following:

   a. Accessibility of the site
   b. Potential flooding conditions and local drainage
   c. Potential nuisance and odor aspects
   d. Noise and visual impact

   The potential for damage or interruption of operation due to flooding shall be considered when locating pump stations. The stations' structures, electrical and mechanical equipment shall be protected from physical damage by the 100 year flood event.

3. Site Security. An 8 foot high masonry screen wall with locked entrance shall enclose the site. The wall shall be compatible with the surrounding environment including landscaping. The locked entrance shall consist of a 16 foot wide, panel style, rollback access gate. Affix warning sign to gate that includes the 24 hour emergency number of the District. Pump station mechanical and electrical equipment shall be constructed to prevent tampering.

4. Sitework. The site shall be graded to provide adequate drainage away from structures. Access for service vehicles to major station components shall be provided. Other sitework shall include the following:

   a. Provide a 4 inch compacted thickness of aggregate base material over the entire site. Base material shall be in accordance with MAG Standard Specification Section 702, Table 702-1.

b. Provide wall mounted area lights with cages over the lenses. The light switch shall be mounted on the interior of the screen wall near the access gate.

5. Masonry Control Building. A masonry control building shall be provided with two separated rooms – one to house the standby generator and the other to house electrical equipment and controls. An emergency eyewash station and wash sink shall be provided at the building.

B. PUMP STATION EQUIPMENT

1. Pump Selection. The selection of sewage pumps shall be made after a thorough analysis of the following factors:

a. Design Flow – The design of the pump station shall be governed by the maximum and minimum flows contributed by the sewage collection system tributary to the pump station. Present and future flows shall be considered. Design flows shall be established using the criteria set forth in Section III.

b. Number and Size of Pumps – The pump station shall be designed to provide a total pumping capability equal to the maximum anticipated flow with at least one of the largest pumps out of service. The number and size of pumps provided depends upon the required capacity and range of flow. In no case shall less than two (2) pumps be provided in a pump station.

c. Type of Pumps – Pumps shall be submersible type with open or non-clog impellers capable of passing a 2.5 inch sphere. Pumps shall be mounted on stainless steel guide rails with a stainless steel chain or cable for pump removal. Companion flange seals, if used, shall be the rubber diaphragm type. Each pump shall be equipped with a mix-flush valve to prevent the accumulation of solids on the floor of the wet well.

d. Motors – Motors shall be oil cooled submersible type, totally enclosed, non-ventilated, constant speed, continuous duty, and explosion proof. Pump motor and power cable shall be approved for use in areas classified as hazardous locations in accordance with the National Electric Code, Class 1, Division 1, Groups C and D service. Electric service to each pump shall be installed with a quick disconnect, explosion proof submersible connector.

e. Pump Operation – Piping, valves and controls shall be arranged to permit independent operation of each pump.

f. Pump Manufacturer – Pumps shall be manufactured by ABS, Davis EMU, Flygt, or an approved equal.

2. Wet Well. Wet well to house the submersible pumps and motors shall include the following minimums:

a. Access – The wet well shall be designed with adequate access for maintenance purposes and have a minimum diameter of 6'-0". No access ladders or steps shall be installed in the wet well.

b. Wet Well Volume – Minimum wet well volume in gallons shall be 1/4 of the product of minimum pump cycle time in minutes, and the total pump capacity, in gallons per minute. Minimum pump cycle time shall be not less than 6 minutes (10 starts per hour).

c. Retention Time – The retention time of the raw sewage in the wet well shall not exceed 30 minutes at average daily design flow. For situations where the retention time is greater than 30 minutes the sewage shall be aerated or chemicals added to prevent or eliminate hydrogen sulfide formation or adequate ventilation provided.

d. Construction Materials – Wet well shall be constructed of precast reinforced concrete pipe and a cast-in-place

reinforced concrete floor and flat top. Wet well shall be reinforced to withstand earth and live loads. The flat top shall be provided with an aluminum gasketed hatch cover over each pump. Each cover shall be of sufficient size to permit pump removal without special equipment. All wet well hardware shall be stainless steel. All hardware shall be coated with anti-seize compound before installation. Discharge piping in the wet well shall be flanged ductile iron pipe Pressure Class 250 with a shop applied two component polyurethane lining. Pipe shall be in accordance with ANSI/AWWA C115/A21.15. Piping shall be painted on the outside with a two coat epoxy system having a total dry film thickness of 7.0 to 11.0 mils.

e. Corrosion Protection – The wet well shall be protected against corrosion by applying an epoxy liner system to the concrete surfaces of the floor, walls and underside of the flat top. The epoxy liner system shall consist of Sewer Shield Liner 101 as manufactured by Environmental Coatings, Inc. Concrete surfaces shall be prepared by abrasive blasting or shot blasting as recommended by the manufacturer. Sewer Shield Liner 101 shall be trowel applied to a thickness of 1/8 inch.

3. Valve Vault. Valve vault to house the pump station control valves on the discharge piping shall include the following minimums:

a. A minimum of 8 feet clear depth shall be provided to allow a person to stand fully upright.

b. An aluminum access hatch and permanent aluminum ladder shall be provided.

c. A drain or sump shall be provided in all vaults.

d. Enclosed vaults shall have a supply fan and air intake.

e. Piping in the vault shall have a minimum of 3 feet clearance from the vault floor. Piping shall be flanged ductile iron pipe Pressure Class 250 with a shop applied two component polyurethane lining. Piping shall be in accordance with ANSI/AWWA C115/A21.15. Piping shall be painted on the outside with a two coat epoxy system having a total dry film thickness of 7.0 to 11.0 mils.

f. Isolation plug valves shall be full ported, epoxy lined with stainless steel seats and position indicators. Gate valves will not be permitted.

g. Check valves shall be swing type, epoxy lined, with external arm and spring assist.

h. Flanged dismantling joints or Victaulic type groove couplings shall be provided at appropriate locations in the piping layout for ease in the repair or replacement of the flanged valves. Locations shall be as directed by the District.

4. Pump Hoist. A pump hoist shall be provided that is capable of lifting each pump from the wet well for inspection or repair. The hoist shall be permanently installed adjacent to the wet well.

5. Standby Generator. A fixed standby power source (diesel fueled) shall be provided for the pump station that can be put into service immediately and remain available for continuous 24 hour per day operation. The generator, transfer switch and controls shall be installed in a masonry building designed to be consistent with any architectural requirements of the District or the appropriate governmental entity.

6. Odor Control. An odor control system shall be provided which is compatible with the most current design in use by the District.

7. Flow Monitoring. A magnetic flow meter shall be provided to measure sewage flows discharged from the pump station.

Meter shall be installed in a straight run of pipe in accordance with manufacturer's recommendations. Meter shall be Sparling Tiger Mag or an approved equal.

8. Remote Monitoring. A telemetry system for remote monitoring of pump station operating conditions shall be provided which is compatible with the system currently in use by the District.

   A Cellular based telemetry collection and reporting device can be used on lift stations with 3 pumps or less, providing cellular service is available at that location. The Cellular unit needs to provide a minimum of 7 inputs for alarm and operation data (alarms must have delay on these inputs), 3 inputs to monitor pump operation (provide run times), and a minimum of two inputs to be used for pulse signals from flow meters (provide flow data). The telemetry data (alarms, run signals, run times, flows) can be available to the operators via a web interface. The Cellular system will also perform multiple operator notifications when an alarm condition exists. The operator notification phone numbers and order can be configurable via a web interface.

9. Electrical Controls. Control panels shall be equipped with Square D components or District approved equals. Controls shall be provided for pump operation based on water levels in the wet well, high and low water level alarms, and alternating pump operation. Running time meters shall also be provided for each pump.

C. FORCE MAINS

1. General. Force mains conveying under pressure the discharge of pump stations shall meet the design, installation and testing requirements in the following paragraphs.

2. Velocity Requirements. Force mains shall be sized to maintain a minimum flow velocity of three (3) feet per second and a maximum flow velocity of seven (7) feet per second.

3. Materials of Construction.

a. Pipe materials shall be one of the following:

- Ductile Iron Pipe – 4" through 12" – Centrifugally cast and conform to the requirements of ANSI/AWWA C151/A21.51 with a Pressure Class of not less than 350. Pipe shall be coated on the outside with an asphaltic coating in accordance with ANSI/AWWA C151/A21.51.

- Polyvinyl Chloride Pipe – 4" through 12" – Conforming to the requirements of AWWA C900 with cast iron pipe outside diameters, a dimension ratio of 18 and a Pressure Class of 150.

b. Affidavit of Compliance. Manufacturer shall furnish an affidavit that all delivered pipe materials comply with the requirements of the specified standards.

c. Pipe Joints:

- Ductile Iron Pipe. Push-on joints shall conform to ANSI/AWWA C111/A21.11 and shall include synthetic rubber gaskets and lubricant. Mechanical joint ends shall conform to ANSI/AWWA C111/A21.11 and shall include cast iron glands, synthetic rubber gaskets, and T-head bolts and nuts. Flanged ends shall conform to ANSI/AWWA C115/A21.15. Bolts and nuts for buried flanges shall be Type 316 stainless steel, ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts.

- Polyvinyl Chloride Pipe – Push-on joints shall conform to AWWA C900 and shall include synthetic rubber gaskets and lubricants.

d. Pipe Fittings: Fittings for ductile iron pipe and polyvinyl chloride pipe shall be ductile iron conforming to

ANSI/AWWA C110/A21.10 or C153/A21.53 with a minimum pressure rating of 250. Fittings shall be coated on the outside with an asphaltic coating in accordance with ANSI/AWWA C151/A21.51. Push-on and mechanical joint ends including accessories shall conform to ANSI/AWWA C111/A21.11. Flanged ends shall conform to ANSI/AWWA C110/A21.10.

e. Linings. Ductile iron pipe and fittings shall be shop lined on the interior with a 40 mil thick two component polyurethane material. Joint sockets and spigots shall be coated with a polyurethane or epoxy material compatible with the lining. Field cut ends and damaged areas shall be sealed and repaired as recommended by the manufacturer. Interior lining shall be Polythane, by U.S. Pipe, or an approved equal.

4. Force Main Construction.

a. Installation. Except as otherwise required in this Section of the Standards, trench excavation, backfilling, compaction and installation of force mains shall be in accordance with MAG Standard Specification Sections 601 and 610. Trench widths, pipe laying, bedding material, backfill, compaction and pavement replacement shall be in accordance with Section III, Part C of these Standards. Pipe joint deflections shall be limited to one degree or 67 percent of the manufacturer's recommended maximum allowable deflection whichever is less.

b. Separation. When a force main is adjacent to or crosses a potable water line special protection may be required to protect the water line from contamination by the force main. Separation requirements and protection details shall be in accordance with MAG Standard Detail No. 404. A reclaimed water line shall be considered a potable water line when adjacent to or crossing a force main.

c. Discharge Point. Force mains discharging into manholes shall be piped in a manner to prevent cascading and release of odorous or corrosive gases.

d. Isolation Valves. Isolation valves shall be considered in the construction of force mains over 400 feet in length. Valves shall be full port plug valves, epoxy lined with stainless steel seats.

e. Air Release. Air release valves designed specifically for raw sewage applications shall be provided at all high points in the force main.'

f. Cleanouts. One-way and/or two-way cleanouts shall be considered in the construction of force mains over 400 feet in length.

g. Corrosion Protection. Buried ductile iron pipe and fittings shall be protected from external corrosion by encasement in a polyethylene protective wrapping. This polywrap shall be in accordance with MAG Standard Specification Section 610, Subsection 610.5.

h. Thrust Forces. Cast-in-place concrete thrust blocks and/or restrained pipe joints shall be provided, where necessary, to prevent movement and/or joint separation of the force main. Construction plans shall show thrust blocks or restrained pipe joint locations and details. Thrust blocks shall be in accordance with MAG Standard Detail No. 380 and 381. Restrained joint design shall be in accordance with MAG Standard Detail No. 303.

i. Testing. Force mains shall be pressure and leakage tested after completion of backfill. Testing shall be conducted at a minimum pressure of 50 pounds per square inch above the design working pressure. This pressure shall be maintained for a period of 4 hours and the quantity of water required to maintain full test pressure for this period shall be measured and recorded. The quantity of water shall not exceed:

$$L = \frac{JD\sqrt{P}}{4500}$$

Where:

L = maximum allowable leakage in gallons per hour for the section of force main tested

J = Number of joints in length tested

D = Inside diameter of pipe in inches

P = Test pressure in pounds per square inch

D. OPERATION AND MAINTENANCE

1. Confined Space Requirements. For safety during operation and maintenance, design pump stations to conform with all applicable state and federal confined space requirements.

2. O&M Manuals. Provide final copies of installation, operation and maintenance manuals for filing in the District office.

SECTION V – RECLAIMED WATER DELIVERY SYSTEM

A. INTRODUCTION

1. General. This section describes standards for the purpose of conveying reclaimed water for permitted reuse. The color purple shall be used for identifying all pipes, valves, and other equipment used for conveying reclaimed water.

B. TRANSMISSION AND DISTRIBUTION MAINS

1. Depth of Cover. For reclaimed water piping, the minimum depth from finished grade to top of pipe (minimum cover) shall be as follows:

   a. Constant pressure lines 4 inches and larger – 6 feet
   b. Constant pressure lines smaller than 4 inches – 2 feet
   c. Intermittent pressure lines – 1.5 feet

2. Materials of Construction.

   a. Pipe materials shall be one of the following:

      - Ductile Iron Pipe – 3" through 20" – Centrifugally cast and conforms to the requirements of ANSI/AWWA C151/A21.51 with a Pressure Class of not less than 250. Pipe shall be coated on the outside with an asphaltic coating in accordance with ANSI/AWWA C151/A21.51.

      - Polyvinyl Chloride Pipe – 4" through 12" – Conforming to the requirements of AWWA C900 with cast iron pipe outside diameters, Dimension Ratio of 18 and a Pressure Class of 150.

      - Polyvinyl Chloride Pipe – 14" through 20" – Conforming to the requirements of AWWA C905 with cast iron pipe outside diameters, Dimension Ratio of 25 and a Pressure Rating of 165.

b. Affidavit Of Compliance: Manufacturer shall furnish an affidavit that all delivered pipe materials comply with the requirements of the specified standards.

c. Pipe Joints:

- Ductile Iron Pipe. Push-on joints shall conform to ANSI/AWWA C111/A21.11 and shall include synthetic rubber gaskets and lubricant. Mechanical joint ends shall conform to ANSI/AWWA C111/A21.11 and shall include cast iron glands, synthetic rubber gaskets, and T-head bolts and nuts. Flanged ends shall conform to ANSI/AWWA C115/A21.15. Bolts and nuts for buried flanges shall be Type 316 stainless steel, ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts.

- Polyvinyl Chloride Pipe – Push-on joints shall conform to AWWA C900 and C905 and shall include synthetic rubber gaskets and lubricants.

d. Pipe Fittings: Fittings for ductile iron pipe and polyvinyl chloride pipe shall be ductile iron conforming to ANSI/AWWA C110/A21.10 or C153/A21.53 with a minimum pressure rating of 250. Fittings shall be coated on the outside with an asphaltic coating in accordance with ANSI/AWWA C151/A21.51. Push-on and mechanical joint ends including accessories shall conform to ANSI/AWWA C111/A21.11. Flanged ends shall conform to ANSI/AWWA C110/A21.10.

e. Isolation Valves: Isolation valves shall be gate valves in accordance with MAG Standard Specification Section 630, Subsection 630.3. Gate valves shall be installed in the system at a maximum spacing of 2000 feet.

f. Valve Boxes: Valve boxes shall be in accordance with MAG Standard Detail No. 391-1, Type C, and painted purple, except that they shall be modified in accordance

with MAG Standard Specification Section 616, Subsection 616.4.4.

g. Combination Air Valves: Combination air and vacuum valves shall be installed at each high point in the pipeline and placed in a vault which allows access for maintenance. Any piping from the valves must be plumbed to drain into the nearest sanitary sewer manhole. Air valve assemblies shall be equal to Apco, Crispin or Val-Matic.

h. Polyethylene Encasement: Polyethylene encasement shall be furnished and installed for protecting buried valves and buried ductile iron pipe and fittings. Encasement shall be in accordance with MAG Standard Specification Section 610, Subsection 610.5.

i. Linings. Ductile iron pipe and fittings shall be shop lined on the interior with a 40 mil thick two component polyurethane material. Joint sockets and spigots shall be coated with a polyurethane or epoxy material compatible with the lining. Field cut ends and damaged areas shall be sealed and repaired as recommended by the manufacturer. Interior lining shall be Polythane, by U.S. Pipe, or an approved equal.

3. Identification

a. Tape. Identification tape shall be an inert polyethylene plastic impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. The tape shall be a minimum of 4.0 mils thick and no less than 3 inches wide. The tape shall be purple and shall have the words, "CAUTION: RECLAIMED WATER LINE" or similar wording printed in black lettering continuously along the entire length. Lettering shall be a minimum 1-1/2 inches high. Spacing between the individual words of the message shall not exceed three inches.

b. Sleeving. Identification sleeving (pipe socks) shall be an inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. The sleeving shall be a minimum of 4.0 mils thick. The sleeving shall be purple and shall have the words, "CAUTION: RECLAIMED WATER LINE" or similar wording printed in black lettering continuously along the entire length. Lettering shall be a minimum of 1-1/2 inches high. Spacing between the individual words of the message shall not exceed three inches.

c. Decals. Identification decals shall be made of inert material resistant to cracking, peeling, and fading due to sunlight and heat. Decals shall have an aggressive adhesive to ensure permanent bonding to the surface that is being identified. The decals shall have the words, "CAUTION: RECLAIMED WATER – DO NOT DRINK" or similar wording printed in black lettering on a purple background. Lettering shall be a minimum 1 inch high. Spacing between the individual words of the message shall not exceed three inches.

d. Stenciling. Reclaimed water pipe identified by stenciling shall use paint or ink resistive to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. Stenciled pipe shall have the words, 'CAUTION: RECLAIMED WATER – DO NOT DRINK" or similar wording printed in black or white lettering on a purple background continuously along the entire length. Lettering shall be a minimum of 1-1/2 inches high. Lettering shall be placed on a painted purple band a minimum of 3 inches wide that runs the entire length of the pipe.

e. Locating Tape. Locating tape shall be an inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. The tape shall be a minimum of 4.0 mils thick, 3 inch wide and contain a minimum

thickness of 1/3 mil metallic foil or two embedded copper wires. The tape shall be purple and printed with the words, "CAUTION: RECLAIMED WATER LINE BELOW" or similar wording printed in black lettering continuously along the entire length. Lettering shall be a minimum 1-1/2 inches high. Spacing between the individual words of the message shall not exceed three inches.

f. Colored Pipe. Integral colored reclaimed water pipe shall be purple in color and shall have the words, 'CAUTION: RECLAIMED WATER-DO NOT DRINK" or similar wording printed in black lettering at intervals no greater than 3 feet. Lettering shall be a minimum 1-1/2 inches high. Spacing between the individual words of the message shall not exceed three inches.

g. Valve Tags. Reclaimed water valve tags shall be inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. The tags shall be purple and shall have the words, 'CAUTION: RECLAIMED WATER-DO NOT DRINK" or similar wording printed in black lettering. The lettering shall be a minimum of 1/2 inch high.

4. Installation.

a. General. Except as otherwise required in this Section of the Standards, trench excavation, backfilling, compaction and installation of reclaimed water mains shall be in accordance with MAG Standard Specification Sections 601, 610 and 616. Trench widths bedding material, backfill, compaction and pavement replacement shall be in accordance with Section III, Part C of these Standards.Pressure and leakage testing shall be conducted at a minimum pressure of 150 psi, unless directed otherwise by the District.

b. Pipe Laying. Pipe shall be laid with a uniform bearing under the full length of the barrel. The pipe shall be assembled and joined in accordance with the manufacturer's instructions. Pipe joint deflections shall be limited to one degree or 67 percent of the manufacturer's recommended maximum allowable deflection whichever is less.

c. Valves. Isolation valves shall be installed in accordance with MAG Standard Specification Section 610 and MAG Standard Detail No. 301-Blocking and No. 391, Type C – Valve Box and Cover.

d. Thrust Forces. Cast-in-place concrete thrust blocks and/or restrained pipe joints shall be provided, where necessary, to prevent movement and/or joint separation of the pipe line. Construction plans shall show thrust blocks or restrained pipe joint locations and details. Thrust blocks shall be in accordance with MAG Standard Detail No. 380 and 381. Restrained joint design shall be in accordance with MAG Standard Detail No. 303.

e. Separation. When a reclaimed water main is adjacent to or crosses a potable water main, the reclaimed water main shall be considered a gravity sewer or a sanitary force main and comply with MAG Standard Detail No. 404 for separation and or protection. When a reclaimed water main is adjacent to or crosses a gravity sewer or a sanitary force main, the reclaimed water main shall be considered a potable water main and comply with MAG Standard Detail No. 404.

f. Above Ground Pipe. Pipe installed above ground shall be ductile iron pipe and identified by stenciling or decals in conformance with this Section of the Standards. Stenciled pipe shall be installed so that the wording runs along both sides of the pipe. Decals shall be placed on both sides of the pipe at intervals no greater than 3 feet. Surfaces shall be prepared to ensure proper adhesion of the decals.

g. Below Ground Pipe. Ductile iron pipe, fittings and valves installed below ground shall be identified with polyethylene sleeving installed so the wording runs along the top of the pipe. Care shall be exercised to avoid displacement of soils and to ensure its integrity.

h. Locating Tape. Purple locating tape shall be installed in the trench directly over the reclaimed water delivery pipe and 12-18 inches below finished grade. The tape shall be printed with the words, "CAUTION-RECLAIMED WATER LINE BELOW" or similar wording.

i. Locator Wire - A purple AWG No. 14 locator wire shall be installed above all reclaimed water delivery pipe. There shall be a minimum of 1 foot separation between locator wire and detection tape. The locator wire shall terminate with a minimum of three (3) feet of a coiled wire inside valve boxes. Wire shall be neatly rolled with ends securely taped and hung in an out-of-the-way location. Locator wire shall be taped to the top of all the reclaimed water delivery pipe at 3 foot intervals. All splices are to be tight and water proofed with 3M DBY Splice Kit No. 054007-09053 or approved equal. Acceptance of locator wire will be made at finish grade.

C. PUMP STATIONS AND FORCE MAINS

Pump stations and force mains shall conform to Section III of these Standards and be labeled and identified in accordance with this Section.

D. STORAGE FACILITIES

Reclaimed water storage facilities shall conform to the requirements of ADEQ Engineering Bulletin No. 10, Chapter 6, AWWA Guidelines For Distribution Of Nonpotable Water and any other applicable State of Arizona requirements for

reclaimed water storage facilities. Storage facilities shall be labeled and identified in accordance with this Section.

SECTION VI – LAUNDROMATS

A. INTERCEPTORS

Each building sewer service on a commercial laundry or Laundromat shall be equipped with an interceptor which will include a wire basket or other suitable straining device, removable for cleaning, that prevents passage into the Arizona City Sanitary District sanitary sewers of solids 1/4-inch and larger such as strings, rags, buttons, lint, or other solids that could be detrimental to the Arizona City Sanitary District sanitary sewage collection system and treatment facilities.

Interceptors installed at commercial laundries and Laundromats shall be cleaned and maintained by the owners of the commercial laundries and Laundromats and shall be installed so they are readily accessible for cleaning and maintenance and for inspection by the Arizona City Sanitary District or other authorities.

Owners of commercial laundries and Laundromats shall prevent all inflow of rain water or other surface run-off in the sanitary sewers.

GENERAL CONDITIONS ELDER VALVE/MONUMENT INSTALLATION:

▶ **Requirements necessary to pass First Inspection:**

- The elder valve will be installed in the easement or right-of-way.
- If a tap extends from the sewer main to the edge of the easement, it shall be CUT back approximately 2 feet (or more) to make room for the elder valve installation in the easement or right-of-way.
- In the event the sewer main is tapped, the elder valve shall be installed between the main and the edge of the easement or right-of-way.
- Elder Valve MUST maintain a true and vertical position (straight up and down at a 90° angle). The standpipe must be cut to grade level. The plastic cap must be installed.

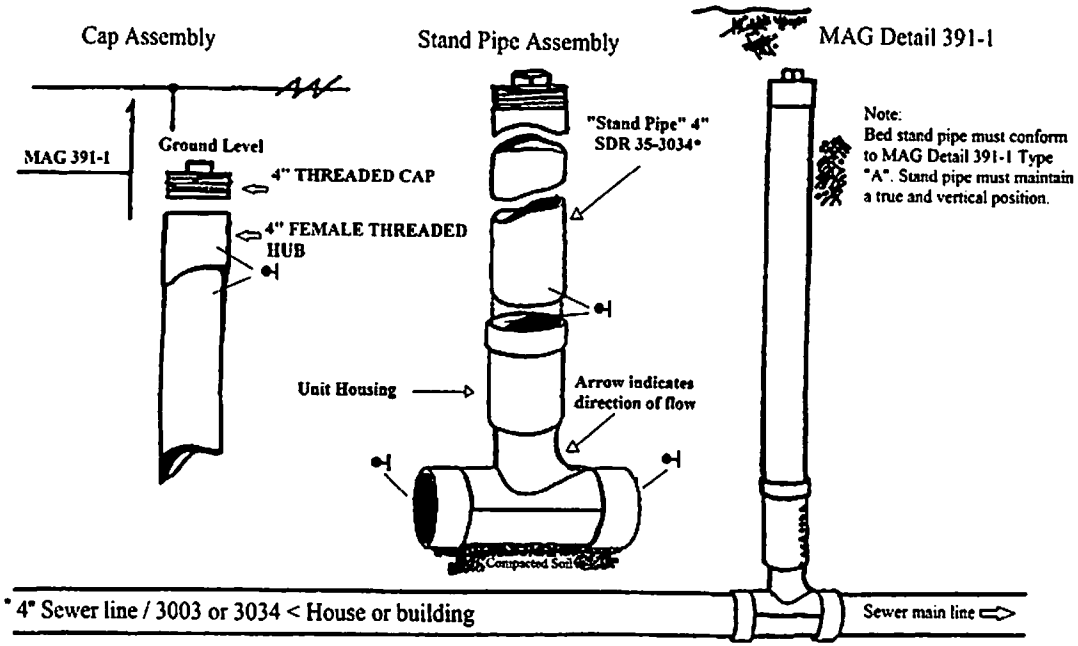
▶ **Requirements necessary to pass Second (Final) Inspection:**

- **Monument:** In accordance with MAG Standards (Detail No. 391-1 Type "A"), the soil surrounding the standpipe must be compacted and the monument (cast iron valve box) be cemented 1" above finished grade level.

The District must approve all exceptions to the above.

Installation Instructions

THE ELDER VALVE DISCONNECT SEWER LINE CLEANOUT



KEY: Prime and solvent weld

Recommended - SDR 35 (Standard Dimension Ratio) No. 3034

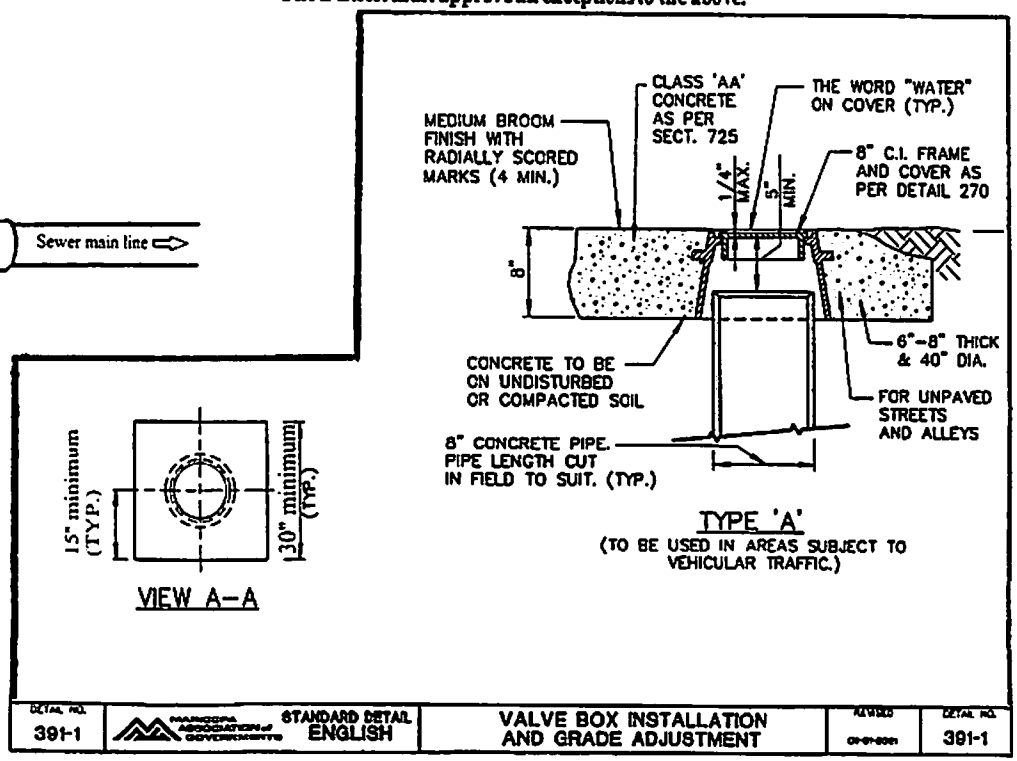


Exhibit "A"