

**TITLE 18. ENVIRONMENTAL QUALITY**  
**CHAPTER 9. DEPARTMENT OF ENVIRONMENTAL QUALITY**  
**ARTICLE 3. AQUIFER PROTECTION PERMITS**  
**PART E. TYPE 4 GENERAL PERMITS**

**R18-9-E301. 4.01 General Permit: Sewage Collection Systems**

D. Design requirements.

2. Gravity sewer lines. An applicant shall:

- a. Ensure that any sewer line that runs between manholes, if not straight, is of constant horizontal curvature with a radius of curvature not less than 200 feet;
- b. Cover each sewer line with at least 3 feet of earth cover meeting the requirements of subsection (D)(2)(h). The applicant shall:
  - i. Include at least one note specifying this requirement in construction plans;
  - ii. If site-specific limitations prevent 3 feet of earth cover, provide the maximum cover attainable, construct the sewer line of ductile iron pipe or other design of equivalent or greater tensile and compressive strength, and note the change on the construction plans; and
  - iii. Ensure that the design of the pipe and joints can withstand crushing or shearing from any expected static and live load to protect the structural integrity of the pipe. Construction plans shall note locations requiring these measures;
- c. If sewer lines cross or are constructed in floodways;
  - i. Place the lines at least 2 feet below the level of the 100-year storm scour depth and calculated 100-year bed degradation and construct the lines using ductile iron pipe or pipe with equivalent tensile strength, compressive strength, shear resistance, and scour protection.
  - ii. If it is not possible to maintain the 2 feet of clearance specified in subsection (D)(2)(c)(i), using the process described in R18-9-A312(G), provide a design that ensures that the sewer line will withstand any lateral and vertical load for the scour and bed degradation conditions specified in subsection (D)(2)(c)(i);
  - iii. Ensure that sewer lines constructed in a floodway extend at least 10 feet beyond the boundary of the 100-year storm scouring;
  - iv. If a sewer line is constructed in a floodway and is longer than the applicable maximum manhole spacing distance in subsection (D)(3)(a), using the process described in R18-9-A312(G), provide a design that ensures the performance standards in subsection (B) are met; and
  - v. Note locations requiring these measures on the construction plans;
- d. Ensure that each sewer line is 8 inches in diameter or larger except the first 400 feet of a dead end sewer line with no potential for extension may be 6 inches in diameter if the design flow criteria specified in subsections (D)(1)(a) and (D)(1)(b) are met and the sewer line is installed with a slope sufficient to achieve a velocity of at least 3 feet per second when flowing full. If the line is extended, the applicant seeking the extension shall replace the entire length with larger pipe to accommodate the new design flow unless the applicant demonstrates with engineering calculations that using the existing 6-inch pipe will accommodate the design flow;
- e. Design sewer lines with at least the minimum slope calculated from Manning's Formula using a coefficient of roughness of 0.013 and a sewage velocity of 2 feet per second when flowing full.
  - i. An applicant may request a smaller minimum slope under R18-9-A312(G) if the smaller slope is justified by a quarterly program of inspections, flushings, and cleanings.
  - ii. If a smaller minimum slope is requested, the applicant shall not specify a slope that is less than 50 percent of that calculated from Manning's formula using a coefficient of roughness of 0.013 and a sewage velocity of 2 feet per second.
  - iii. The ratio of flow depth in the pipe to the diameter of the pipe shall not exceed 0.75 in

- peak dry weather flow conditions;
- f. Design sewer lines to avoid a slope that creates a sewage velocity greater than 10 feet per second. The applicant shall construct any sewer line carrying a flow with a normal velocity of greater than 10 feet per second using ductile iron pipe or pipe with equivalent erosion resistance, and structurally reinforce the receiving manhole or sewer main;
  - g. Design and install sewer lines, connections, and fittings with materials that meet or exceed manufacturer's specifications consistent with this Chapter to:
    - i. Limit inflows, infiltration, and exfiltration;
    - ii. Resist corrosion in the ambient electrochemical environment;
    - iii. Withstand anticipated static and live loads; and
    - iv. Provide internal erosion protection;
  - h. Indicate trenching and bedding details applicable for each pipe material and size in the design plans. Unless the Department approved alternative design standards or specifications under subsection (D)(1)(c), the applicant shall place and bed the sewer lines in trenches following the specifications in "Trench Excavation, Backfilling, and Compaction" (Section 601) revised 2004, published by the Maricopa Association of Governments; and "Rigid Pipe Bedding for Sanitary Sewers" (WWM 104) revised July 2002, and "Flexible Pipe Bedding for Sanitary Sewers" (WWM 105) revised July 2002, published by Pima County Wastewater Management. This material is part of the material incorporated by reference in subsection (D)(1)(b).
  - i. Perform a deflection test of the total length of all sewer lines made of flexible materials to ensure that the installation meets or exceeds the manufacturer's recommendations and record the results;
  - j. Test each segment of the sewer line for leakage using the applicable method below and record the results:
    - i. "Standard Test Method for Installation of Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air, F1417-92(1998)," published by the American Society for Testing and Materials;
    - ii. "Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method, C924-02 (2002)," published by the American Society for Testing and Materials;
    - iii. "Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines, C828-03 (2003)," published by the American Society for Testing and Materials;
    - iv. "Standard Test Method for Hydrostatic Infiltration Testing of Vitrified Clay Pipe Lines, C1091-03a (2003)," published by the American Society for Testing Materials;
    - v. "Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines, C969-02 (2002)," published by the American Society for Testing Material; or
    - vi. "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications, D2321-00 (2000)," published by the American Society for Testing Materials; or
    - vii. The material listed in subsections (D)(2)(j)(i) through (vi) is incorporated by reference and does not include any later amendments or editions of the incorporated material. Copies of the incorporated material are available for inspection at the Arizona Department of Environmental Quality, 1110 W. Washington, Phoenix, AZ 85007 or may be obtained from the American Society for Testing and Materials International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959;
  - k. Test the total length of the sewer line for uniform slope by lamp lighting, remote camera or similar method approved by the Department, and record the results; and
  - l. Minimize the planting within the disturbed area of new sewage collection system construction of plant species having roots that are likely to reach and damage the sewer or impair the operation of the sewer or visual and vehicular access to any manhole.