CHAPTER 6: WASTEWATER FACILITIES

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6.0 INTRODUCTION

All residential developments must be served by wastewater collection and treatment facilities. Options for new developments include expansion of existing community wastewater systems, construction of individual wastewater treatment systems, or the construction of a new community wastewater collection and treatment facilities. New community treatment systems can range from small to medium-size conventional systems, or alternate systems including land-based wastewater treatment systems. The Pennsylvania Clean Streams Law (PA Code, Title 25, Chapter 91) and the Pennsylvania Sewage Facilities Act (Act 537 of 1996, as amended) require that any person planning to construct a new wastewater collection or treatment facility shall first obtain permits from the Pennsylvania Department of Environmental Protection.

The terms used to describe the methods of wastewater treatment are frequently not used consistently, which can lead to a great deal of confusion. This document is consistent in its use of terms as defined by the PA Code.

The terms “individual” and “on-lot” are frequently used interchangeable, but they are not the same in the regulations. On-lot is used to refer to systems that involve a soil-based treatment, either a soil absorption area or a spray field. On-lot is also used to refer to systems that use a retention tank that is periodically pumped, with the waste being taken to another facility for disposal. Individual refers to a sewage facility serving a single lot. It can refer to an on-lot system such a septic tank and leach field or a system that doesn’t utilize soil renovation such as a Small Flow Treatment Facility.

According to the U.S. Census Bureau, decentralized or on-lot wastewater systems serve nearly 25% of U.S. households. The demand for housing has pushed residential development into rural areas typically not served by existing public wastewater treatment facilities. As a result, almost 40% of new developments in Pennsylvania require some type of wastewater facility. The required septic field size coupled with necessary isolation distances often result in the need for lots in developments supported by on-lot septic systems to be larger and larger rather than smaller and/or clustered. As a result, large lot developments are adding significantly to urban sprawl, and the loss of environmentally sensitive lands, and rural open space.

To accommodate the need for housing and the pressures for development within rural areas, protect environmental resources, and maintain open space, treatment alternatives that accommodate smaller, clustered lots are necessary. This requires that traditional views of wastewater treatment be reconsidered, and more innovative on-lot treatment options be permitted.

Recommended Standards

This chapter provides standards and guidance for the design of individual and community-based systems, including collection and conveyance systems, based on PA Code, Title 25, chapters 71-73 (Reference 1).

This document only addresses gravity conveyance systems because they are the most common and to prevent the document from becoming too cumbersome. Standard engineering practice should be used in the design of vacuum and pressure systems.

6.1 GENERAL

6.1.1 Authority and General Requirements

a. Procedures for the design of wastewater facilities are included in the Pennsylvania Sewage Facilities Act (Act 537, as amended) (Ref. 3). This act:

- Requires proper planning and permitting of all types of wastewater facilities;
- Requires permitting of individual and community on-lot wastewater systems; and
- Provides for uniform standards for the design of on-lot systems.

b. Wastewater facilities planning, design, and construction shall be conducted in compliance with current PA DEP regulations. All sewage facilities planning shall also be coordinated with the local municipality.

c. No lot may be developed or subdivided unless suitable for an approved wastewater treatment system.
Exceptions:

i. Minor plat adjustments: Wastewater treatment facilities shall not be required for subdivisions that are plat adjustments, that is, where no new lots are created.

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Permitting and Planning Forms
The following planning and permitting forms are available from the PA DEP eLibrary at http://164.156.71.80/wxod.aspx. (Ref. 2)

Sewage Facilities Planning Module Application Mailer
(3800-CD-WSFR0359)
Used by anyone proposing a new land development project. This is the first step in the permitting process. The information provided will be used by the DEP to determine if sewage facilities planning is necessary for your project, and if so, what forms are appropriate.

Municipal officials and the municipality's Sewage Enforcement Officer should be consulted in the development of the project.

Pennsylvania Natural Diversity Inventory (PNDI)

The "Policy for Pennsylvania Natural Diversity Inventory (PNDI) Coordination During Permit Review and Evaluation" (400-0200-001) requires that a PNDI database search be conducted regardless of which planning modules

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are applicable.

A self-conducted "PNDI Project Planning Environmental Review" search can be conducted by accessing the Pennsylvania Natural Heritage Web Site (Ref. 4).

Or, a "PNDI Project Planning and Environmental Review Form" (PNDI Form), available through the Pennsylvania Natural Heritage web site (Ref. 4) can be submitted to request that DEP staff conduct the database search.

Request for Planning Waiver and Non-Building Declaration (3800-FM-WSFR0349) (formally known as "Form B") can be downloaded from the PA DEP eLibrary (Ref. 2) at http://164.156.71.80/wxod.aspx
This form is used to propose subdivisions that do not involve the creation of new sewage facilities. It can only be used when there is no present or future need for wastewater treatment on the project site. This form may not be used as a means to simply defer wastewater planning.

The Planning Waiver and Non-Binding Declaration is not intended to be a deed restriction preventing a future owner from subdividing the property.

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ii. Subdivision Plans with no proposed development: Subdivisions and land development for which no development of buildings or improvements to the land are proposed need not provide wastewater treatment, provided a properly executed Request for Planning Waiver and Non-Building Declaration has been submitted to and approved by the PA DEP. Where a waiver is approved by DEP, the final plan and deed for land shall include the following notation:

For Plans Where Sewage Facilities are not Required.

As of the date of this deed/plot plan recording, the property/subdivision described herein is and shall be dedicated for the express purpose of _____ _____use. No portion (or lot number(s) _____) of this property/subdivision are approved by _____(Municipality) or the Department of Environmental Protection (DEP) for the installation of any sewage disposal facility. No permit will be issued for the installation, construction, connection to or use of any sewage collection, conveyance, treatment or disposal system (except for repairs to existing systems) unless the municipality and DEP have both approved sewage facilities planning for the property/subdivision described herein in accordance with the Pennsylvania Sewage Facilities Act (35 P.S. Sections 750.1 et seq.) and regulations promulgated thereunder. Prior to signing, executing, implementing or recording any sales contract or subdivision plan, any purchaser or subdivider of any portion of this property should contact appropriate officials of _____ (municipality), who are charged with administering the Sewage Facilities Act to determine the form of sewage facilities planning required and the procedure and requirements for obtaining appropriate permits or approvals.

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d. No plans shall be approved or recorded until the wastewater treatment system is approved according to applicable regulations.

In addition, as-built drawings that document the horizontal and vertical location and details of any new wastewater collection, conveyance and treatment facilities shall be submitted to and approved by the local wastewater regulatory authority prior to Final Plat approval. As-build drawings are not required for individual on-lot septic systems.

e. Wastewater conveyance systems shall not be used to carry stormwater.

f. Wastewater treatment standards detailed within this section shall be applicable to all subdivision and land developments, whether utilizing public or private streets or driveways serving as private streets. In the case of a subdivision or land development utilizing private streets, the developer shall provide appropriate easements and execute a recordable covenant with the municipality or wastewater authority for the purpose of permitting access for operation and maintenance of said wastewater facilities.

g. Flood proofing: All wastewater sewer systems located in flood-prone areas, whether public or private, shall be flood-proofed. The following is a partial list of steps to be taken to flood-proof wastewater facilities:

- The top-of-casting elevation of manholes shall be located one (1) foot above the established 100-year flood level or regulatory flood elevation.
- Watertight manhole frame and covers shall be used.
- Above-grade treatment facilities shall be protected to one (1) foot above the established flood level or regulatory flood elevation by levees or other flood-proofing technique.

6.1.2 Availability of Public Sewage Facilities

a. If the site is within an area planned for sewer service by a Municipal Act 537 Sewage Facilities Plan or Capital Improvement Program, and if a collection system conveying wastewater to a public wastewater treatment facility is available within the following distances and has adequate capacity, then all lots within the subdivision and/or land development shall be connected to the existing wastewater collection system:

Maximum distance from property boundary (not structure) to wastewater conveyance facility requiring connection to said collection facility.

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Backflow valves are designed to block the drain pipes temporarily and prevent flow into the house, which can cause damage and serious health hazards (Ref. 5).

The Pennsylvania Sewage Facilities Act (Act 537, as amended) (Ref. 2) requires proper planning of all types of wastewater facilities, permitting of individual and community on-lot wastewater treatment systems and provides for uniform standards for designing on-lot treatment systems. The standards contained in this section are reproduced from Reference 2.

Commentary

The standard noted in section 6.1.2.a for the maximum distance to connect a subdivision to a wastewater treatment conveyance system is based on the Lancaster County Subdivision and Land Development Ordinance. A review of ordinances from across the state shows a lot of variety in the way this issue is treated. Distances in ordinances range for 200 to 2,000 feet. Other ordinances didn't specify a distance but used vague language such as "when deemed possible" that would allow for inconsistent application. The standard used in this document was selected for its ability to be applied consistently and fairly based on the size of the development.

In Second Class Townships, the Code (Ref. 20) states that properties or principal buildings within 150 feet shall connect to sanitary sewer systems.

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- Single lot of unit — two hundred (200) feet
- Two lots or units — four hundred (400) feet
- Three lots or units — six hundred (600) feet
- Four lots or units — eight hundred (800) feet
- Five to fifteen lots or units — one thousand (1,000) feet
- More than fifteen lots or units — one mile

For developments of more than 15 units that are less than one mile from an existing public sewer conveyance system, a waiver of the requirement to connect may be granted by the local approving authority. Said waiver must be requested in writing by the developer, and must be supported by adequate justification. Adequate justification shall include a statement from the licensed design professional identifying the adequacy of the proposed treatment method, economic considerations, and consideration of the requirements of the municipal wastewater treatment facilities plan.

For developments of greater than fifteen (15) units, which are more than one mile from an existing system, the wastewater facilities strategy shall be determined on a case-by-case basis, taking into consideration the density of development, economic considerations and the requirements of the municipal wastewater treatment facilities plan. Refer to section 6.2.1.f when the developer is required to oversize the conveyance system for a development future.

b. The municipality reserves the right to require a Feasibility Report to compare on-lot versus community or public wastewater treatment options.

c. When the proposed development is not consistent with the approved Act 537 Sewage Facilities Plan, the applicant must request a revision to the plan to support the proposed development

d. Where a development site is within the municipalities proposed sewer service area as defined through an approved Act 537 plan or a capital improvements plan, but is further away from the existing conveyance system than specified in section 6.1.2.a above, the developer shall have the option to request that the local sewer authority extend the existing lines to his site. If the authority agrees to extend the sewer line, the developer shall be responsible to reimburse the authority for the cost of a length of sewer line extension equivalent to the maximum extension distance defined in the requirements of section 6.1.2.a.

If the sewer line is not extended to the site, the developer shall install sewer lines, including lateral connections to the edge of the road right-of-way, as may be necessary

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to provide adequate service to each lot when connection with the public wastewater system is made. The sewer lines shall be suitably capped at the limits of the subdivision, and the laterals shall be capped at the right-of-way line. The sewer installation shall include the construction of all necessary sewer lines within the development as are necessary for future connection to the public wastewater system. All components of the system shall be designed and constructed in accordance with the standards of the PA DEP, this ordinance, and applicable sewer authority standards.

6.1.3 Classification of Wastewater Facilities

Title 25, Chapter 71 of the Pennsylvania Code classifies wastewater facilities as follows.

Individual Sewage Systems -- A system of piping, tanks or other facilities, serving a single lot and collecting and disposing of sewage in whole on in part into the soil or into waters of the Commonwealth or by means of conveyance to another site for final disposal. The term includes:

Individual on-lot sewage system -- An individual sewage system that uses piping, tanks or other facilities for collecting, treating and disposing of sewage into a soil absorption area or spray field or by retention in a retaining tank.

Individual sewerage system -- An individual sewage system that uses pipes, tanks, or other facilities for collection, treatment, and disposal of sewage other than renovation in a soil absorption area, or retention in a retaining tank.

Community Sewage System -- A sewage facility, whether publicly or privately owned, for the collection of sewage from two or more lots, or two or more equivalent dwelling units and the treatment or disposal, or both, of the sewage on one or more of the lots or at another site. The term includes:

Community onlot sewage system -- A system of piping, tanks or other facilities serving two or more lots and collecting, treating and disposing of sewage into a soil absorption area or retaining tank located on one or more of the lots or at another site.

Community sewerage system -- A publicly or privately owned community sewage system that uses a method of sewage collection, conveyance, treatment and disposal other than renovation in a soil absorption area, or retention in a retaining tank.

Commentary

The classification scheme outlined here uses consistency in terminology to characterize wastewater systems. The meaning of each term is as follows:

Individual - Refers to a sewage facility serving a single lot.

Community – Refers to sewage facilities including collection, conveyance, treatment and disposal of wastewater from two or more lots.

Onlot sewage – Refers to a wastewater facility that uses a soil absorption area or retaining tank for treating and disposing of sewage.

Sewerage – Refers to a wastewater facility that uses a treatment and disposal method other than renovation in a soil absorption area or retention tank.

Commentary

A community wastewater facility is a publicly or privately owned system that includes wastewater collection, conveyance, treatment and disposal. These facilities include both large authority-operated wastewater facilities serving a single municipality or several municipalities, to smaller facilities designed to treat the waste from two or more dwelling units or lots. Treatment methods include conventional "plants", small modular package facilities, as well as oil-based treatment systems. The *PA Sewage Enforcement Officer Manual* provides examples and image of many different types of wastewater treatment systems.

The terms "on-lot" and "sewerage" are used in state regulations to distinguish where the wastewater is treated.

> On-lot is used to refer to systems that involve a soil-based treatment, either a soil absorption area or a spray field. On-lot is also used to refer to systems that use a retention tank that is periodically pumped, with the waste being taken to another facility for disposal.
>
> Sewerage is used to refer to any treatment method that does not use soil-based waste renovation techniques, or does not use retention tanks.

The term "conventional" is used to refer to treatment systems that are explicitly identified in state regulations as being a demonstrated method of treatment when used in the manner specifically recognized by the regulation. The term does not include alternate or experimental systems.

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6.2 COMMUNITY WASTEWATER FACILITIES

6.2.1 General

Community wastewater facilities shall be designed in accordance with the most current version of the *PA DEP Domestic Wastewater Facilities Manual* (Ref. 6). In addition, the following general requirements shall be met:

a. Wherever practical, wastewater sewers shall be installed and connected to a public wastewater treatment facility.

b. The Final Plan Application for the land development or subdivision shall include certification from the applicable authority that the capacity exists to accommodate the need. Application shall also include a statement from the applicable authority indicating the approval of the plans for design, installation and possible financial guarantee.

c. If the applicable authority does not have sufficient capacity, the municipality shall not approve a final subdivision or land development plan.

d. The wastewater sewer systems improvement shall be extended to the boundary line of the development or subdivision to provide access to service by adjacent properties. All such improvements shall be designed as to accommodate the future needs of the municipality with respect to wastewater treatment service as included in the Act 537 Municipal Sewage Facilities Plan or Capital Improvement Plan.

e. No on-lot (soil-based) wastewater treatment system shall be used at any time upon any property that has been connected to a public wastewater sewer system.

f. When plans for future development necessitate oversizing or grade changes, the municipality or utility authority may enter into an agreement with the developer to address the fair share of the cost of improvements not required for the proposed development. If the developer needs to oversize the system to accommodate future development on adjoining property, there should be cost-sharing between the developer and the municipality for the over-sizing.

g. The applicant shall submit details of all planned sewer facilities including conveyance, treatment, and disposal, as applicable to the municipality and/or utility authority, for review and approval to ensure compliance with this section.

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6.2.2 Conveyance System

6.2.2.1 Design and Placement -- General

a. Sewer lines within Municipal Right-of-Way: When sewer lines are located within the municipal right-of-way, they shall be located as follows:

   i. When located under the paved roadway, sanitary sewer manholes shall be located at or near the centerline of the paved roadway, but at least five (5) feet from the edge of pavement.

   ii. When located adjacent to the paved roadway, sanitary sewer manholes shall be located at least ten (10) feet inside the right-of-way line.

   iii. When conditions require that sewer facilities (manholes, pipes, or other facilities) come within ten (10) feet of the right-of-way line, a construction easement shall be provided outside the right-of-way sufficient to maintain a 20 foot construction zone centered on the sewer pipe.

b. Sanitary sewer lines located outside Municipal Right-of-way: Sanitary sewer lines located outside the municipal right-of-way shall be located in a Sanitary Sewer Easement. These easements shall be a minimum of twenty (20)-feet wide for wastewater sewers that are not more than fifteen (15)-feet deep, and a minimum of thirty (30)-feet wide for sanitary sewers more than fifteen (15)-feet deep. The depth of sewer shall be measured from the design invert of the pipe to the surface of the proposed final grade.

   Where the easement is located adjacent to a right-of-way, the municipality or authority may approve a narrower easement.

c. Sanitary sewer easements shall be in a form approved by the municipality and/or utility authority.

d. Except where shallower depths are permitted by the municipality or utility authority, sewer lines, including laterals, shall be constructed at least three (3) feet below the proposed grade (as measure from the top of the pipe to the grade elevation).

e. Wastewater piping shall be shall be placed at slopes that equal or exceed the minimum slopes identified in Table 6-1 (or more current values as identified in a more current version of Reference 6):

Commentary

To provide service, wastewater collection lines typically must run adjacent to each lot in a development. They typically run adjacent to either the front or rear property lines; the exact location depends on the proposed development configuration, topography, utility corridor limitations, and maintenance considerations. Utility corridor limitations include development density, the location of other utilities, and the placement of other site or development amenities (landscaping, sidewalks and trails, etc.).

Consideration should be given to accessibility and the cost of repair when locating wastewater lines; for convenience, wastewater collection lines are often run in public rights-of-way, under the roadway pavement or adjacent to it. Wastewater lines located under the pavement provide convenient access to manhole locations, however, pipe repair requires that the street be torn up and repaired. When sewer lines are placed in the right-of-way, a utility corridor or backyard easement, the roadway is not disturbed for pipe repair but there are difficulties in accessing the manholes with cleaning equipment, and street trees can conflict with underground pipes in the right-of-way.

Easements provide the right to use the land for the sewer and also provide the right of entrance for maintenance.

Commentary

Some flexibility should be provided in permitting for slopes slightly less than those required as long as two foot per second, full-flow velocity is maintained.

The per-capita flow of 100 gallons per day is an average value assumed to include normal infiltration and inflow. This value has been used as the average per capita flow since the 1960s. The current trend towards low-flow appliances, shower restrictors, and low-flow toilets (required under the Pennsylvania building code), coupled with construction practices that have reduced or eliminated inflow and infiltration for new construction, may warrant

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Table 6-1. Gravity Slope Standards

Pipe Size (inches)	Slope (feet per 100 feet)
6	0.60
8	0.40
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046

Source: PA DEP, *Domestic Wastewater Facilities Manual*, Ref. 6

f. Sanitary sewer pumping stations shall be considered where gravity system design leads to excessive sewer depths that are not economically justifiable.

6.2.2.2 Sizing and Flow Criteria

a. Wastewater conveyance facilities shall be sized according to the most current edition of the PA DEP Domestic Wastewater Facilities Manual (Ref. 6). The following standards are current as of this writing:

   i. New wastewater conveyance systems should be designed on the basis of an average daily per capita flow of not less than one-hundred (100) gallons per day unless a lower design per-capita flow rate can be established based on actual measured flow data.

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ii. A peaking factor shall be applied to the average daily per-capita flow to accommodate the peak flow (Illustration 6-a).

iii. Generally, sanitary sewers should be designed to carry, when flowing full, not less than the following daily per-capita contributions of domestic wastewater, exclusive of wastewater from non-residential users:

- Laterals and sub-main sewers -- 400 gallons per capita per day.
- Main, trunk interceptor and outfall sewers -- 250 gallons per capita per day. These values should be reduced when an average daily per-capita flow of less than 100 gallons is justified.

iv. Alternate Method -- Deviations from the above sanitary sewer design flows may be used when justified by data analysis. When deviations from the above design flows are proposed, a description of the procedure used to establish the design flows shall be documented and submitted to the reviewing authority for consideration prior to system design.

v. Minimum wastewater pipe size -- No public sewer carrying untreated wastewater should have a diameter less than eight (8) inches. Refer to section 25.1 of the Domestic Wastewater Facilities Manual (Ref. 6) for exceptions to minimum pipe size.

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the use of a lower design per-capita flow rate. However, the use of a lower value must be justified (see paragraph iv).

Wastewater flows vary throughout the day (see Appendix 6.D) Conveyance systems must be designed to accommodate the expected peak flow rate. This is typically considered to be the average daily flow multiplied by some peaking factor. The design flow of 400 gallons per capita per day and 250 gallons per capita per day here assume peaking factors of 4 and 2.5, respectively. In general, the greater the tributary population, the lower the peaking factor; flow peaks are dampened or averaged with larger populations. Illustration 6-b provides a graphic illustrating suggested peaking factors as a function of population.

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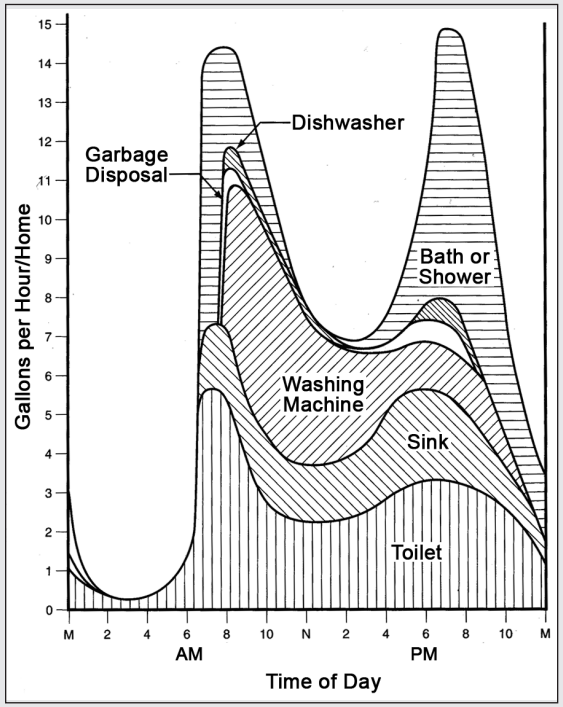
Illustration 6-a. Hourly Variation of Wastewater Flow



Source: *Land Development Handbook,* 2nd Edition. The Dewberry Companies. McGraw-Hill. New York, 2002, Ref. 7

Computation of an alternate wastewater flow may be appropriate based on the use of low-flow appliances and other water-conserving practices. Appropriate design flows can be based on local water use data (usually requires analysis of one-year worth of data), or other sources of measured water use for conditions similar to those proposed (for example, see chapter 3 of Ref. 9).

Assuming an average per-capita flow of 100 gallons/day and a peaking factor of 5 (based on data from Ref. 11), Table 6-a indicates the number of

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housing units that can be served by the minimum 8" sanitary sewer as a function of pipe slope. Manning's n for PVC pipe is 0.013. Pipes are assumed to be flowing full.

Table 6-a. Number of Single-Family Dwellings Served by an 8-inch Diameter Wastewater Pipe

Type of Housing	Average Number of Residents [a]	Maximum Number of Housing Units Tributary to an 8-inch PVC Sewer Pipe at the Given Slopes					
		0.5%	1%	2%	3%	4%	5%
Single-Family Dwelling	2.7	88	125	177	217	251	280
Small Apartment Buildings (less than 5 units)	2.45	97	138	195	239	276	309
Medium Apartment Buildings (5 to 20 units)	1.75	137	193	274	335	387	433
Large Apartment Buildings (20 to 50 units)	1.6	149	211	299	367	423	473
High Rises (more than 50 units)	1.4	171	242	342	419	484	541

[a] Average number of residents per household by structure type is based on Census 2000, Pennsylvania data.

If pipes are assumed to be flowing half full, the number of housing units at each slope will be

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reduced to one half of the number presented in the table.

The following factors should be considered when selecting material for a wastewater sewer system:

- Flow characteristics -- friction coefficient
- Life expectancy and use experience
- Resistance to scour
- Resistance to acids, alkalis, gases, solvents, etc.
- Ease of handling and installation
- Physical strength
- Type of joint -- water tightness and ease of assembly
- Availability and ease of installation of fittings and connections
- Availability in sizes required
- Cost of materials, handling, and installation

Reinforced PVC, ductile iron, and concrete pipe are the most common types of pipe used for wastewater sewer systems, but there are special situations where other types such as Acrylonitrile-Butadiene-Styrene (ABS) and Cement-Lined Asbestos may be an option. Descriptions along with advantages and disadvantages of various pipe materials are provided below (from Ref. 8).

Polyvinyl Chloride (PVC) Pipe

Advantages

- Light weight
- Long laying lengths (in some situations)
- High-impact strength
- Ease in field cutting and tapping

Disadvantages

- Subject to attack by certain organic

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6.2.2.3 Materials

a. Pipe materials used in the construction of gravity sanitary sewers shall be PVC, reinforced concrete, or ductile iron. Other pipe materials may be used if warranted and justified. All pipe and appurtenances shall comply with AWWA and ASTM standards referenced in this paragraph. Where nonmetallic pipe is installed, a metallic locator tape shall also be installed above the pipe.

   i. ***PVC sewer pipe*** shall have bell and spigot ends, and O-ring rubber gasketed joints. PVC pipe and fittings shall conform to ASTM D3034, with a minimum wall thickness designation of SDR 35, or shall conform to ASTM F679, F789, F794, or F949 with a designated pipe stiffness of PS-46.

      1. The plastic material from which the pipe and fittings are extruded shall be impact types of PVC, unplasticized, having high mechanical strength and maximum chemical resistance, conforming to Type 1, Grade 1, of the specification for rigid polyvinyl chloride compounds, ASTM D1784.

      2. Pipe shall be free from defects, such as bubbles or other imperfections, in accordance with accepted commercial practices. Test results demonstrating that the pipe meets ASTM D2444 for impact and ASTM D2321 for deflection and pipe stiffness shall be provided when requested by the municipality or utility authority.

      3. Joints shall conform to ASTM D3212. Rubber-ring gaskets shall conform to ASTM F477. The gasket shall be the sole element depended upon to make the joint watertight.

      4. The pipe shall be installed as specified in ASTM D2321 and as specified in the wastewater sewer trench detail (Figure 6.1). When pipe is to be installed in unstable soil or excessive ground water, a determination regarding special precautions, such as poured concrete slabs, shall be made by the municipal engineer or utility authority engineer.

      5. Bedding, haunching, and initial backfill material shall be placed in accordance with the sewer detail Figure 6.1. All material shall be clean and free flowing, and shall meet all ASTM C33 specifications for quality and soundness.

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ii. Reinforced concrete pipe shall be used only in sizes twenty-four (24) inches and larger, and shall meet all the requirements of ASTM C76. All pipe shall be Class III strength installed with Class C ordinary bedding, except in the following conditions where stronger pipe may be required:

1. For depths less than three (3) feet, measured from the top of the pipe, installed under traffic area, Class IV pipe shall be required.

2. The presence of clay soils, poor bedding conditions, or other unusual loading conditions shall be given special consideration and the developer shall submit an engineering analysis to the municipality or authority for approval.

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chemicals
- Subject to excessive deflection when improperly bedded and haunched
- Limited range of sizes available
- Subject to surface changes affected by long-term ultra-violet exposure

Concrete Pipe

Advantages
- Wide range of structural and pressure strengths
- Wide range of nominal diameters
- Wide range of laying lengths

Disadvantages
- High weight
- Subject to corrosion where acids are present
- Subject to shear and beam breakage when improperly bedded

Ductile Iron Pipe

Advantages
- Long laying lengths
- High pressure and load bearing capacity
- High-impact strength
- High beam strength

Disadvantages
- Subject to corrosion where acids are present
- Subject to chemical attack in corrosive soils
- High weights

Cement-lined Asbestos Pipe

Advantages
- Long laying lengths (in some situations)
- Wide range of strength classifications
- Wide range of fittings available

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Disadvantages
- Subject to corrosion where acids are present
- Subject to shear and beam breakage when improperly bedded
- Low beam strength

Cast Iron Pipe

Advantages
- Long laying lengths (in some situations)
- High pressure and load bearing capacity

Disadvantages
- Subject to corrosion where acids are present
- Subject to chemical attack in corrosive soils
- Subject to shear and beam breakage when improperly bedded
- High weight

Steel Pipe

When used in wastewater sewers, it usually is specified with interior protective coatings or linings (polymeric, bituminous).

Advantages
- Light weight
- Long laying lengths (in some situations)

Disadvantages
- Subject to corrosion where acids are present
- Subject to chemical attack is corrosive soils
- Difficulty in making lateral connections
- Poor hydraulic coefficient (unlined corrugated steel pipe)
- Subject to excessive deflection when improperly bedded or haunched

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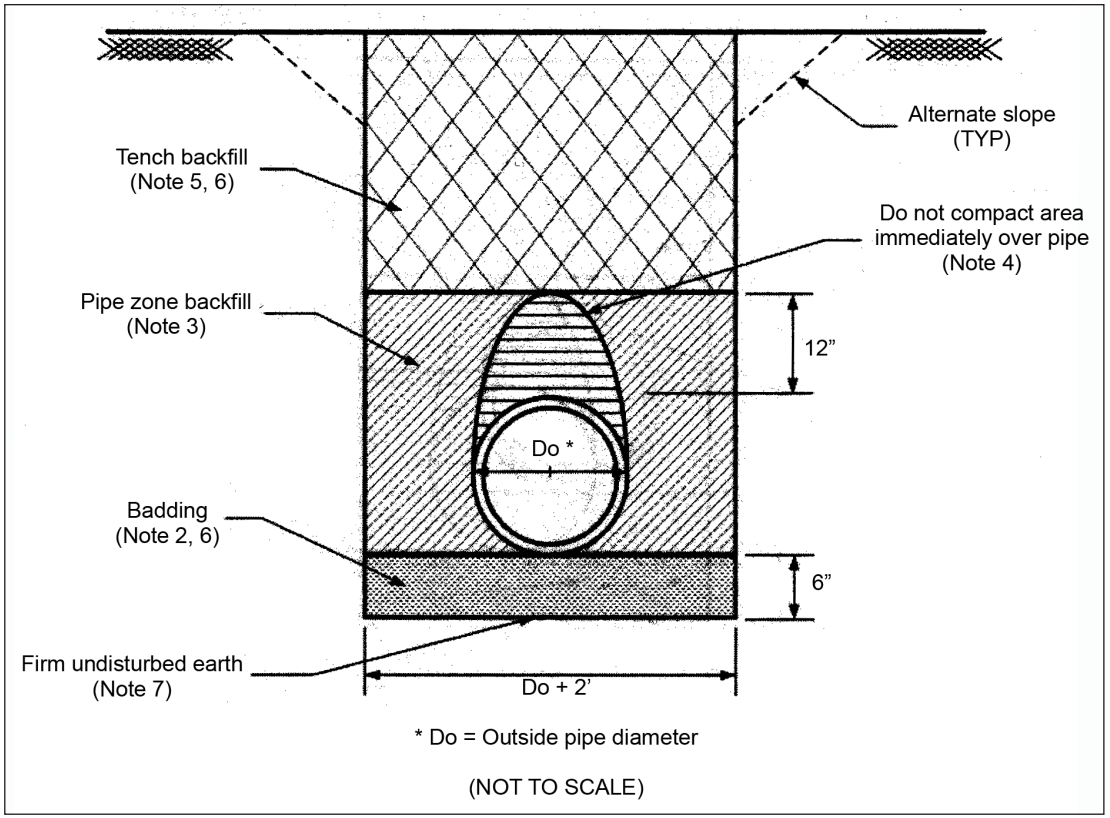


NOTES:

1. When trench backfill exceeds twenty (20) feet or is less than three (3) feet, use reinforced concrete or Class 52 ductile iron pipe.
2. Bedding is to be un-compacted PennDOT 2A coarse aggregate.
3. The pipe zone backfill is to be well compacted PaDOT 2A coarse aggregate. Place and compact pipe zone backfill in four (4) inch lifts to a level one (1) foot above the pipe crown.
4. Do not compact material immediately over the pipe as shown.
5. Trench backfill shall be suitable material placed in four (4) to eight (8) inch lifts and is to compacted to ninety-five (95) percent standard proctor density (SPD). Where the trench passes under pavement, the trench backfill shall be PennDOT 2A coarse aggregate.
6. Suitable material is material containing no debris, organic material, frozen material or larger stones with a diameter greater than one-half (1/2) the thickness of the compacted layers being placed.
7. If unsuitable material exists at the base of the trench, undercut as directed and backfill with suitable material to the bottom of the bedding layer.

Figure 6.1. Sanitary Sewer Line Trench Detail

Recommended Standards

iii. ***Ductile iron pipe*** shall be used for installation where sewer pipe may be subject to high internal or external pressures. Ductile iron pipe can be used as an alternate to concrete pipe in areas where fill depths are less than three (3) feet or greater than twenty (20) feet. Ductile iron pipe should also be used to span areas where bedding support could be lost such as at stream crossings, and in areas where there is a reasonable probability of sinkhole formation.

1. Ductile iron pipe shall be Class 52 with rubber gasketed joints that conform to ANSI/AWWA C111/A21.11. Gasketed flanges can be used where the pipe must connect to flanged fittings.

2. The outside of the pipe shall be coated with a uniform thickness of hot applied asphaltic coasting, and the inside shall be lined with cement in accordance with ANSI/AWWA C104/A21.4.

3. In corrosive soils or in sewers that receive discharge from a force main where hydrogen sulfide is present, ductile iron pipe with polyethylene coating shall be used to protect the inside and outside of the pipe.

b. Inverted siphons and outfalls shall be constructed of ductile iron pipe or PVC pipe, as specified above. Inverted siphons shall consist of a minimum of two (2) pipes with provisions for flushing. Flow control gates shall be provided in the chambers. (Refer to Section 25.1 of Ref. 6).

c. For other than PVC pipe, pipe and manhole bedding shall be provided as specified in Reference 8, *Gravity Sanitary Sewer Design and Construction, ASCE Manual on Engineering Practice, No. 60*. Any pipe material not covered by this manual shall be installed in accordance with the manufacturer's recommendations.

i. The municipality or the authority may require the developer to provide the opinion of a professional engineer regarding the suitability of the on-site material to be used as backfill. The municipality or authority shall rely of this opinion.

ii. Where the on-site material is deemed suitable, the professional's opinion shall specify the appropriate installation methods for the material. Where the on-site material is deemed not suitable, the opinion shall specify modification or replacement of the material and the appropriate installation methods for the specified material.

Commentary

- Subject to turbulence abrasion

Acrylonitrile-Butadiene-Styrene (ABS) Pipe

Advantages

- Light weight
- Long laying lengths (in some situations)
- High impact strength
- Ease in field cutting and tapping

Disadvantages

- Limited range of sizes available
- Subject to environmental stress cracking
- Subject to excessive deflection when improperly bedded and haunched
- Subject to attack by certain organic chemicals
- Subject to surface change effected by long-term ultra-violet exposure

Table 6-b Typical size ranges and descriptions of common sewer pipe material

Type of pipe	Typical size range (in)	Description
Cement-lined asbestos	4-36	Weighs less than other commonly rigid pipes. May be susceptible to acid corrosion and hydrogen sulfide attack, but if properly cured with steam at high pressure (autoclave process), may be used even in environments with moderately aggressive waters of soils with high-sulfate content.

Commentary

Ductile iron	4-54	Often used for river crossings and where the pipe must support unusually high loads, or where unusual root problems are likely to develop. Ductile-iron pipes are susceptible to acid corrosion and hydrogen sulfide attack, and therefore should not be used where the groundwater is brackish, unless suitable protective measures are taken.
Reinforced concrete (RCP)	12-144	Readily available in most localities. Susceptible to corrosion of interior if the atmosphere over wastewater contains hydrogen sulfide, or from outside if buried in an acid or high sulfate environment.
Prestressed concrete	16-144	Especially suited to long transmission main without building connections and where precautions against leakage are required. Susceptibility to corrosion (the same as reinforced concrete).
Polyvinyl chloride (PVC)	4-15	A plastic pipe used for sewers as an alternative to cement-line asbestos and vitrified clay pipe. Lightweight but strong. Highly resistant to corrosion.

Source: Metcalf & Eddy, Inc., 1981, Ref. 10

The maximum distance between manholes is based on the length of pipe that can be cleaned with avail-

Recommended Standards

Recommended Standards

6.2.2.4 Manholes

a. *Manhole location:* Manholes shall be located at all sewer pipe junctions and at locations where a change in pipe slope is required. In a straight section of pipe on constant grade, manholes should be spaced no more than four-hundred (400) feet apart.

b. *Manhole construction:* Manhole construction shall comply with the standards in *ASCE Manual on Engineering Practice No. 60* (Reference 8) and shall meet the following requirements.

i. Manholes shall be precast concrete or concrete block. Manhole barrels shall be a minimum of four (4) feet in diameter when serving sewers twenty-four (24) inches or less in diameter and shall be a minimum of five (5) feet in diameter when serving sewers greater than twenty-four (24) inches in diameter

Where manholes are precast, the base and first section shall be monolithically cast. Concrete block shall be coated with two coats of Portland cement mortar.

Precast concrete or concrete block shall be sealed with two coats of an acceptable waterproofing tar, asphalt, or polyplastic alloy, with enough time allowed between the seal coasts to bond.

ii. When a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An approximate method of securing these results is to place the 0.8 depth point of both sewers at the same elevation.

iii Where pipe size varies, crowns of pipes shall be matched, unless authorized otherwise by the approving authority.

iv Flow channels shall be placed in all manhole bases. Flow channels shall be smooth and accurately shaped to a semi-circular bottom conforming to the inside of

Commentary

able equipment. The required separation distance should be increased or decreased as necessary to permit cleaning the length of run between manholes.

Typical manhole details are illustrated in illustrations 6-c thru 6-l in Appendix 6.C.

Commentary

Recommended Standards

the adjacent sewer sections.

v. Drop connections shall be made where the invert of any inlet pipe is two (2) feet or more higher than the invert out of the manhole.

vi. If precast manhole barrels and cones are used, they shall conform to ASTM C478, with round rubber-gasketed joints conforming to ASTM C443. Maximum absorption shall be nine (9) percent, in accordance with ASTM C478, Method A.

Manholes be watertight.

The top riser section of precast manholes shall terminate less than eighteen (18) inches below the finished grade to provide for proper adjustment.

vii. Manhole frames and covers shall be of cast iron conforming to ASTM A48, Class 30, or ductile iron conforming to ASTM 536, and shall be suitable for H-20 loading capacity.

All manholes covered in unpaved rights-of-way or in remote areas shall be provided with a locking device, as specified by the municipality or utility authority.

The words “SANITARY SEWER” shall be cast integrally into the manhole cover.

viii. Manholes shall be supplied with flexible, watertight adaptors, such as inserts or gaskets, conforming to ASTM C923 and suitable for the pipe material used.

ix. Masonry units shall conform to the following requirements:

1. Brick shall be manufactured using clay or shale, burned, and meeting the requirements of ASTM C-62.

2. Concrete block masonry units shall be manufactured in solid precast segmented units and meet the requirements of ASTM C-139.

3. The use of a Type S, or equivalent, mortar should be used in below ground applications.

6.2.2.5 Laterals and Cleanouts

Laterals and cleanouts shall comply with the following standards:

Recommended Standards

a. One (1) or two (2) dwelling units may be served from a single sewer lateral connection to the main. When two (2) dwelling units are connected through a single lateral connection, the lateral connection is referred to as a "common lateral connection".

   Where site conditions allow, two dwellings may be served by a single common lateral connection between the sewer main and the edge of right-of-way or sewer easement. The single lateral from the main can be split using a "y" connection at the property or easement line. The lateral shall only be shared to the edge of the right-of-way so no additional easement or maintenance agreement is needed.

b. The service lateral from the sewer main to the cleanout located at the edge of the right-of-way or sewer easement shall be considered an integral part of the sanitary sewer system. Sewer laterals shall be constructed of schedule 40 or SDR 35 PVC pipe having a four (4) inch minimum diameter. The following pipe materials may also be used:

   - cast-iron soil pipe, extra heavy;
   - ABS plastic pipe, SDR 35; or
   - ductile iron pipe.

   Common laterals (see section 6.2.2.5 a.) shall have a six (6)-inch minimum diameter.

   Service laterals shall be constructed at a minimum 2% slope.

c. Wye connections shall be the same material as the sewer main. Saddles shall be used only for connection to an existing main.

d. Cleanouts shall be provided at fifty (50)-foot intervals in all four (4)-inch diameter sewer laterals and at one-hundred (100)-foot intervals in all six (6)-inch sewer laterals.

e. Bends in laterals shall be made using standard fittings. A riser and cleanout shall be provided immediately upstream of any bends in lateral lines.

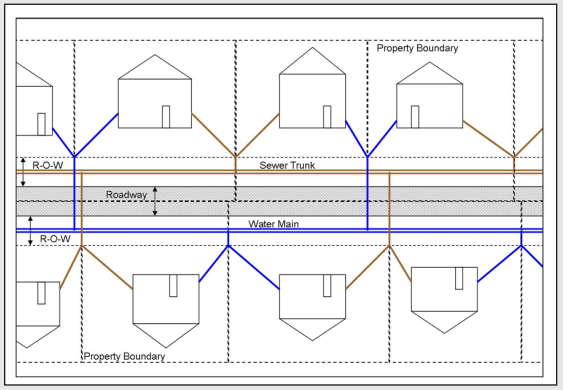
f. All cleanouts shall be fitted with either a metallic cap or a non-metal cap fitted with a metallic plug that is suitable for locating the cleanout. Caps shall have a depressed or inverted nut.

g. Connections beyond the edge of right-of-way or sewer easement are under the jurisdiction of the Plumbing Subcode of the Uniform Construction Code through the plumbing subcode official. The pipe size, slope, and specifications shall comply with the regula-

Commentary

Common lateral connections can be used to minimize the number of main connections and, thus, minimize the associated initial and maintenance costs. Fewer lateral connections will also minimize utility conflicts within the right-of-way. Illustration 6.g shows how a development might use common laterals for water and sewer connections. Illustration 6.h provides a detail of the wye connection.

Illustration 6-b. Common Lateral Connection



Common lateral connection branching to individual homes at the intersection of the right-of-way and property boundary.

See Appendix 6.C for Illustrations 6-c to 6-l for standard details.

Commentary

Locating wastewater sewers in streets or other public properties is generally preferred for ease of maintenance and to avoid conflicts with property owners. If sewers must be placed on private property, an easement should be dedicated to provide the right of access for construction, inspection, maintenance and repair.

Where possible, wastewater sewers should not be located near water supply pipes. Sometimes avoidance is not possible, in which case common practice is to use a pressure-type pipe with mechanical joints. The pipe may also be encased in concrete.

Recommended Standards

tions and requirements of the Plumbing Subcode of the Uniform Construction Code.

Typically, laterals should have a 2% slope. A 1% slope is an option when necessary.

h. Deep-Cut Laterals

i. Where elevations of main sewers and service connections are such that require lateral trenching of over seven (7) feet, a riser connection off the main shall be made.

ii. Riser assemblies consist of a Wye inserted in the main sewer with an elbow for plumb. Place a six (6)-inch diameter riser pipe of a length terminating at a height allowing the shallow lateral trenching. Place an elbow on the riser pipe and extend lateral to two (2) feet inside the property line and cap off.

iii. Where appropriate, place a Wye on top of riser pipe and extend to surface, properly capped for a clean-out.

iv. Sewer main and riser pipe shall be encased to the height of elbow or Wye with Class B concrete, at a minimum of six (6) inches thick.

6.2.2.6 Vertical and Horizontal Separation of Sanitary Sewer and Potable Water Lines

Refer to Ref. 6 for the most up-to-date standards.

a. Vertical Separation

i. Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least eighteen (18) inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet this requirement, the water main shall be raised to provide this separation, for a distance of ten (10) feet extending on each side of the sewer

ii.. Where less than eighteen (18) inches vertical separation exists between the water and sewer lines, the sewer line shall be encased in Class B concrete for ten (10) feet on either side of the water main.

iii. If possible, one full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.

iv. The sewer line shall be pressure-tested to assure water tightness prior to backfilling.

Recommended Standards

v. Where possible, sewers crossing water mains shall be constructed so that the sewer joints will be equidistant and as far as possible from the water main joints.

vi. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water main.

vii. Where a wastewater sewer line crosses over or under a utility other than water supply, a vertical separation of twelve (12) inches shall be maintained between them.

b. Horizontal Separation

i. Whenever possible, sewers shall be laid at least ten (10) feet horizontally, from existing or proposed water mains.

ii. If local conditions prevent a lateral separation of ten (10) feet, a sanitary sewer line may be laid closer than ten (10) feet to a water main if:
- It is laid in a separate trench; or if
- It is laid in the same trench, with the water main located at one side of a bench of undisturbed earth; and if
- In either case the elevation of the top (crown) of the sewer is at least eighteen (18) inches below the bottom (invert) of the water main.

6.2.3 Conventional Sewerage Treatment Facilities

Conventional sewerage treatment facilities include all facilities that use a means of treatment and disposal other than renovation in a soil absorption area or retention in a retaining tank.

a. The design of a community sewerage systems shall comply with PA Code Title 25, Chapters 71 through 73 (Reference 1) and the guidance of the *PA DEP Domestic Wastewater Facilities Manual* (Reference 6).

b. The engineer/develop shall confer with the PA DEP before proceeding with the design of detailed plans for wastewater treatment facilities.

c. Space shall be provided to allow for plant expansion in the event of a population expansion or requirement for additional treatment.

Commentary

It is recommended that a wastewater treatment plant be located at least 250 feet from occupied dwellings and recreational areas.

The direction of prevailing winds should be considered when locating a treatment plant.

The varied design flow terminology used wastewater facility often creates confusion. Table 6-c summarizes the name, general definition, and typical

Commentary

application of the commonly used design flow parameters. Refer to the current version of Ref. 6 for up-to-date terminology.

Table 6-c. Summary of Design Parameters

Design Flow Parameter	General Definition	Typical Application
Annual Average Flow	The total flow received at the facility during any one calendar year divided by 365 (the number of days in that period).	• The "nominal" design flow of a facility. • Used for cost comparisons and annual estimates of O&M costs. • Used for water quality modeling. • Used for evaluating Act 537 plan updates. • Used to determine allowable mass loadings in NPDES permits.
Monthly Average Flow	The total flow received at the facility during any one calendar month divided by the number of days in that month.	• A flow reporting parameter used in discharge monitoring reports.
Maximum Monthly Average Flow	The highest monthly average flow during any one calendar year.	• Determine the overall hydraulic design of the facility. • Used for evaluating Act 537 plan updates and planning modules. • Is the "hydraulic capacity" for Chapter 94 determinations? • Establishes the monthly average flow limitation on NPDES permit.

Recommended Standards

d. Sewage treatment facilities, including all electrical and mechanical equipment, shall be protected from physical damage by the 100-year flood. The treatment plant shall be designed to remain fully operational and accessible during the 25-year flood.

Recommended Standards

Commentary

Peak Hourly Flow	The maximum flow rate received at the facility averaged over a period of one hour.	• Designing clarifiers, chlorine contact tanks, and other hydraulically sensitive units.
Peak Instanta-neous flow	The maximum instantaneous flow rate received at the facility at any given time.	• Designing comminutors, pump stations, piping, and units subject to peak flow conditions.
Minimum Hourly Flow	The least flow rate received at the facility over a period of one hour.	• Designing pump stations, and other units sensitive to excessive deten-tion times.

e. Design Flow

i. For municipal systems and subdivision of over one hundred and fifty (150) homes, the design annual average flow shall be based on one hundred (100) gallons per capita per day, with a twenty-four (24)-hour runoff period.

ii. The design annual average flow for plans serving less than one hundred and fifty (150) homes shall be based on seventy-five (75) gallons per capita per day, with a sixteen (16)-hour runoff period.

iii. Any deviation from these values shall be based on actual data for water consumption and projected or anticipated flow due to infiltration (during high groundwater conditions).

At the state level, the PA DEP defines design flow on a number of people rather than Equivalent Dwelling Units (EDU) because the number of people in a unit varies across the state. Use census data to determine the local EDU.

6.2.4 Community On-lot Treatment Systems

6.2.4.1 Conventional Community On-lot Treatment Systems

a. Design for a community on-lot wastewater system shall be based on the sewage

For assistance in developing a community sewage manage-

Commentary

ment program refer to the *EPA Handbook for Managing Onsite and Cluster (Decentralized) Wastewater Treatment Systems* (Ref. 11) and *Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems* (Ref. 12).

Flow information for building types other than those presented in Table 6-1 that might be part of a mixed-use community can be found in Title 25 of the PA Code in Chapter 73, Section 17, Subsection b.

According the PA Code, Title 25, Chapter 73 (Ref. 1), alternative wastewater treatment systems provide a classification for innovative and alterative technology that has been developed through the experimental program, by application of existing technologies from other disciplines or through technological advances from other areas of the country. The alternate wastewater treatment system permit provides a method for use of proven technologies without constant changes to the regulations with

Recommended Standards

flow data found in PA Code, Chapter 73, Section 17 Sewage Flows (Ref. 1), as reproduced below in Table 6.2. Refer to Reference 1 for sewage flows for other commercial and institutional establishments.

Table 6.2 Flows for the Design of Community On-lot Wastewater Treatment Systems

Type of Establishment	Gallons/Unit/Day	
Residential	Gallons/unit	BOD/unit
Multiple family dwellings and apartments, including townhouses, duplexes and condominiums	400	1.13
Single family residences	400*	.90

*For units of 3 bedrooms or less; for each bedroom over 3, add 100 gallons

c. The treatment facility(ies), disposal and reserve area(s), and any pump station(s) shall be located on a separate nonresidential lot that shall be dedicated to the municipality.

d. Each on-lot community system is required to provide a reserve area in the event that the system should fail. The reserve area shall be located within soils suitable to support such a system. The suitability of the reserve area shall be determined at the same time that the suitability of the main area is determined.

e. An agreement guaranteeing maintenance of the system shall be prepared by the developer subject to the approval of the municipality. The agreement shall be noted in the deed for each connecting lot and shall specify the responsibilities of each property owner for the proper functioning and maintenance of the system.

6.2.4.2 Alternate Community On-lot Treatment Systems

a. Alternate systems shall be considered for community on-lot systems when any of the following conditions apply:

   i. to solve an existing pollution or public health problem;
   ii. to overcome specific site suitability deficiencies, or as a substitute for systems described in this chapter on suitable lots;
   iii. to overcome specific engineering problems related to the site or its proposed use; or
   iv. to utilize under varying site conditions an experimental design, either in whole or in part, which has been deemed successful by the Department.

b. By definition, alternate systems are on-lot systems, so residential systems shall be sized

Recommended Standards

in accordance with flow values in Table 6-1 or as updated through an amendment or other revision to PA chapter 73, section 17, Sewage Flows (Ref. 1). Also refer to Reference 1 (chapter 73, section 17) for sewage flows for other commercial and institutional establishments.

c. If wastewater flow is in excess of 10,000 gallons per day, refer to the *PA DEP Manual for Land Application of Treated Sewage and Industrial Wastewater* (Ref. 14) for additional design requirements.

Figure 6.2. Land Application of Treated Sewage
Source: West Bradford Township
These spray irrigation fields are located in Chester County.

Commentary

changing technology approvals.

The PA DEP document entitled *Alternate System Guidance* (362-0300-007) (Ref. 13) provides technical standards and design assistance for alternative on-lot systems. As of the publication of the Alternate System Guidance document in February 2006, the allowable alternate systems include:

- Alternate Individually Designed Composting Toilet
- Flow Equalization
- Alternate Peat Based System Options
- Free Access Gravity Sand Filter System Option
- CO-OP RFS III System Option
- Leaching Chambers
- Alternate Aggregates
- Grey water Systems
- At-Grade Bed Systems
- Modified Subsurface Sand Filter for Fast Percolation, Shallow Bedrock Sites with No Water Table Present
- Shallow Placement Pressure Dosed System
- Drip Irrigation System
- Steep Slope Elevated Sand Mound Beds on Slopes Between 12 and 15% and Percolation Rates of 3-30 minutes per Inch
- A/B Soil System (ABS System)
- Non-Infiltration, Evapotranspiration Bed Contained Within a Greenhouse

The PA DEP *Manual for Land Application of Treated Sewage and Industrial Wastewater* (362-2000-009, 10/1997) (Ref. 14) provides information on applicability, permitting, and basic design for large-volume and community on-lot wastewater systems. A large-volume on-lot system will handle wastewater flows in excess of 10,000 gallons per day. A community on-lot system serves two or more

Commentary

Equivalent Dwelling Units (EDUs).

Alternative On-Lot Technology Research: Soil-Based Treatment Systems (Ref. 15) published by the Delaware Valley College Research and Demonstration Center for On-Lot Systems and Small Flow Technology provides guidance for subsurface drip irrigation community systems and treatment data from application to areas with different land uses.

These flow standards are as specified in chapter 73 of Reference 1.

An individual sewage system is a system of piping, tanks or other facilities serving a single lot and collecting and disposing of wastewater in whole or in part into the soil or into waters of the Commonwealth or by means of conveyance to another site for final disposal.

The terms "on-lot" and "sewerage" are used in the state regulations to distinguish where the wastewater is treated.

On-lot is used to refer to systems that involve a soil-based treatment, either a soil absorption area or a spray field. On-lot is also used to refer to systems that use a retention tank that is periodically pumped and waste is taken to another facility for treatment.

Recommended Standards

6.3 INDIVIDUAL ON-LOT SYSTEMS

6.3.1 Design Flow Criteria

a. Wastewater treatment systems for single-family dwellings, not served by a community treatment system, shall be designed based on a minimum flow of 400 gallons per day (gpd) for all dwellings having three (3) bedrooms or fewer. The minimum flow of 400 gpd shall be increased by 100 gpd for each bedroom over three (3).

6.3.2 Conventional Individual On-lot Systems

a. Individual, on-lot treatment systems for single-family dwelling units shall be sized according to the regulations in PA Code Chapter 73 based on the type of treatment to be used.

b. According to Act 357, if neither an active nor a capped wastewater sewer system is installed, easements for sewer installation at a later time must be designated.

c. Approval of the Planning Module from DEP shall be required before approval from the municipality.

d. No septic tank, privy vault, or other similar receptacle shall be connected to a public sewer system

e. No person may install, award a contract for construction of or construct an individual or community on-lot sewage system, or install, construct, occupy or use a building to be served by that system without first obtaining the applicable permits.

f. A permit shall be required for alterations or connections to an existing individual or com-

Recommended Standards

munity on-lot sewage system when the alteration or connection requires the repair, replacement or enlargement of a treatment tank or retention tank, or the repair, replacement, disturbance, modification or enlargement of a soil absorption area or spray field or the soil within or under the soil absorption area of spray field.

g. Soil percolation tests shall be conducted in accordance with the requirements of PA Code, Title 25, chapter 73.15 (Ref. 1).

h. A replacement treatment location may be required if soils are marginal as determined by the PA DEP.

i. If soils are not suitable for a conventional individual on-lot wastewater treatment system, a Small Flow Treatment Facility (SFTF) may be considered. See section 6.4 of this ordinance.

j. Facility Location:

   i. The perimeter of on-lot wastewater treatment facilities shall be recorded in the property deed.

   ii. The location of each individual on-lot wastewater treatment system (and each replacement location if a replacement location is required) as well as any required isolation distances required by the PA DEP shall be shown on the plans.

   iii. All isolation distances must be contained within the property boundary.

   iv. On-lot wastewater treatment facilities shall be set back from street right-of-way a sufficient area to accommodate future street improvements without disturbing the function of the treatment.

   v. On-lot wastewater treatment systems shall be located and/or designed to avoid impairment to them, or contamination from them, during flooding.

   vi. The area reserved for the on-lot wastewater treatment system (and the area of the replacement location if a replacement location is required) for each lot must be fenced and protected from any disturbance during all phases of construction until the issuance of an occupancy permit.

   vii. On-lot wastewater facilities may be located within common and/or restricted open space in lieu of location(s) on the specific lot(s) to be served, where approved by

Commentary

Sewerage is used to refer to any treatment method that does not renovate waste within the soil or retain in a retention tank.

The term "conventional" is used to refer to treatment systems that are explicitly stated within the regulation as being a demonstrated method of treatment when used in a manner specifically recognized by the regulation. The term does not include alternate or experimental systems.

The type and character of the on-lot wastewater treatment system to be installed should be determined on the basis:

- Location
- Topography
- Available area
- Soil characteristics
- Permeability
- Groundwater elevation

The treatment area to be provided shall be determined by the results of:

- Percolation test
- Soil classification
- Depth of water table
- Other tests as may be deemed necessary

Specific design standards for conventional on-lot wastewater systems can be found in PA Code Chapter 73 regulations. The most common type of individual on-lot system installed in Pennsylvania is a septic tank with absorption area. The following standards or most current regulations should be used in the design of a septic system

a. Standards for Septic Tanks
   i. The minimum liquid septic tank capacity for any installing is 900 gallons.
   ii. The minimum septic tank capacity shall be

Commentary

calculated from Table 6-d using the estimated flows from above.

iii. Septic tanks may be connected in series to attain required capacity.

Table 6-d. Minimum Septic Tank Capacity Based on Sewage Flow

Design Flow (gpd)	Tank Capacity (gallons)
0 – 500	(3.5 x flow exceeding 400 gpd) + (900)
500 – 5,000	(1.5 x flow exceeding 500 gpd) + (1,250)
5,000 – 7,500	(1.45 x flow exceeding 5,000 gpd) + (8,000)
7,500 – 10,000	(1.35 x flow exceeding 7,500 gpd) + (11,625)
Over 10,000	1.50 x the daily flow

b. Standards for Absorption Area

Minimum absorption area required for on-lot treatment is based on the amount of flow and the soil percolation rates as shown in Table 6-e below.

Recommended Standards

the Municipality in accordance with applicable zoning regulation.

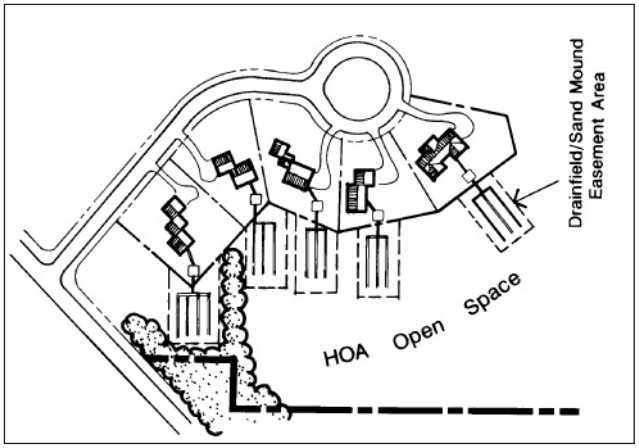


Figure 6.3. On-lot Facilities in Common Open Space
Source: Growing Greener, Ref. 22
Housing lots can be smaller by locating each house's wastewater facility in the community's common open space.

viii. Where any individual on-lot wastewater facilities are located within common or restricted open space not part of the individual lot being served, the location(s) of such facilities shall be monumented and easements satisfactory to the municipality shall be established to require and enable the maintenance of such facilities by the appropriate parties.

ix. Cleanouts shall be provided at the junction of the building drain and building sewer.

x. Cleanouts shall be proved at intervals of not more than one hundred (100) feet.

xi. Bends ahead of the treatment tank shall be limited to forty-five (45) degrees or less where possible. If ninety (90)-degree bends cannot be avoided, they shall be made with two (2) forty-five (45)-degree bends.

xii. The grade of the building sewer shall be at least one eighth (1/8) inch per foot, or a 1% slope; however, the grade of the ten (10) feet of building sewer immediately preceding the treatment tank may not exceed one-fourth (¼) inch per foot, or a 2% slope.

Recommended Standards

Commentary

Table 6-e. Minimum Absorption Area Required for Treatment Tank Effluent

	Square Feet of Aggregate Area per Gallon per Day	
Average Percolation Rate (Min/in)	**All Systems Except Elevated Sand Mounds and Sub-surface Sand Filters**	**Subsurface Sand Filters and Elevated Sand Mounds**
Less than 3.0[D]	Unsuitable	Unsuitable
3 - 5[C]	Unsuitable	1.50[AB]
6 - 15[C]	1.19[B]	1.50[AB]
16 - 30[C]	(Avg. Perc Rate - 15) x (0.040) + 1.19[B]	1.50[AB]
31 - 45[C]	(Avg. Perc Rate - 30) x (0.030) + 1.79[B]	(Avg. Perc Rate - 30) x (0.026) + 1.50[AB]
46 - 60[C]	(Avg. Perc Rate - 45) x (0.028) + 2.24[B]	(Avg. Perc Rate - 45) x (0.022) + 1.89[A]
61 - 90[C]	(Avg. Perc Rate - 60) x (0.023) + 2.66[A]	(Avg. Perc Rate - 60) x (0.020) + 2.22[A]
91 - 120[ACD]	Unsuitable	(Avg. Perc Rate - 90) x (0.017) + 2.82[A]
121 - 150[CD]	Unsuitable	(Avg. Perc Rate - 120) x (0.015) + 3.33) (1.05)[A]
151 - 180[CD]	Unsuitable	(Avg. Perc Rate - 150) x (0.014) + 3.78) (1.10)[A]
Greater than 181[CD]	Unsuitable	Unsuitable

Notes:

A Pressure dosing required.

B One-third reduction may be permitted for use of an aerobic tank.

C May be considered for experimental or alternate proposals.

D Unsuitable for subsurface sand filters

Commentary

Siting Considerations
According to PA Code, Title 25, 73.12 (at time of this publication):

When locating a proposed absorption area or spray field areas, the following characteristics should be avoided.

1. The slope of the proposed absorption area or spray field is greater than 25%.
2. The area is identified by completed Federal Flood Insurance mapping as a floodway. Where there is no flood mapping, a flood way extends 50 feet from the top of the stream bank as determined by the local agency.
3. One or more rock outcrops exist within the proposed absorption area.
4. In areas underlain by limestone, depressions left by earlier sinkholes exist either in whole or in part within the proposed absorption area or spray field.

Absorption areas or spray fields may not be placed in or on fill unless the fill has remained in place for a minimum of 4 years to allow restoration of natural permeability.

Minimum Horizontal Isolation Distances
According to PA Code, Title 25, 73.13 (at time of this publication):

If conditions warrant, greater isolation distances may be required for any of the features listed below.

1. The minimum horizontal isolation distances between the feature named and treatment tanks, dosing tanks, lift pump tanks, filter tanks and chlorine contact/storage tanks:

    a. Property line, easement or right-of-way

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- 10 feet.
b. Occupied buildings, swimming pools and driveways - 10 feet.
c. An individual water supply or water supply system suction line - 50 feet.
d. Water supply line under pressure - 10 feet.
e. Streams, lakes or other surface waters - 25 feet.
f. A cistern used as a water supply - 25 feet.

2. The minimum horizontal isolation distances between the feature named and the perimeter of the aggregate in the absorption area:
a. Property line, easement or right-of-way -- 10 feet.
b. Occupied buildings, swimming pools and driveways -- 10 feet.
c. An individual water supply or water supply system suction line -- 100 feet.
d. Water supply line under pressure -- 10 feet.
e. Streams, water courses, lakes, ponds or other surface water -- 50 feet (for this requirement, wetlands are not considered surface waters).
f. Other active on-lot systems -- 5 feet.
g. Surface drainageways -- 10 feet.
h. Mine subsidence areas, mine bore holes or sink holes -- 100 feet.
i. Rock outcrop or identified shallow pinnacle -- 10 feet.
j. Natural or manmade slope greater than 25% -- 10 feet.
k. A cistern used as a water supply -- 25 feet.
l. Detention basins, retention basins and stormwater seepage beds -- 10 feet.

3. The minimum horizontal isolation distances between the feature named and the wetted perimeter of the spray field:

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a. Property lines, easements or right of ways -- 25 feet.
b. Occupied buildings and swimming pools -- 100 feet.
c. An individual water supply or water supply suction line -- 100 feet.
d. A cistern used as a water supply -- 25 feet.
e. Water supply line under pressure -- 10 feet.
f. Streams, watercourses, lakes, ponds or other surface waters -- 50 feet. (for this requirement, wetlands are not considered surface waters).
g. Mine subsidence, boreholes, sinkholes -- 100 feet.
h. Roads or driveways -- 25 feet.
i. Unoccupied buildings -- 25 feet.
h. Rock outcrop -- 25 feet.

4. The area within the wetted perimeter of the spray field may not be sited over an unsuitable soil profile.

The PA DEP document entitled *Alternate System Guidance* (362-0300-007) (Ref. 13) provides technical standards and design assistance for alternative on-lot systems. As of the publication of the *Alternate System Guidance* document in February 2006, the allowable alternate systems include:

- Alternate Individually Designed Composting Toilet
- Flow Equalization
- Alternate Peat Based System Options
- Free Access Gravity Sand Filter System Option
- CO-OP RFS III System Option
- Leaching Chambers
- Alternate Aggregates

Recommended Standards

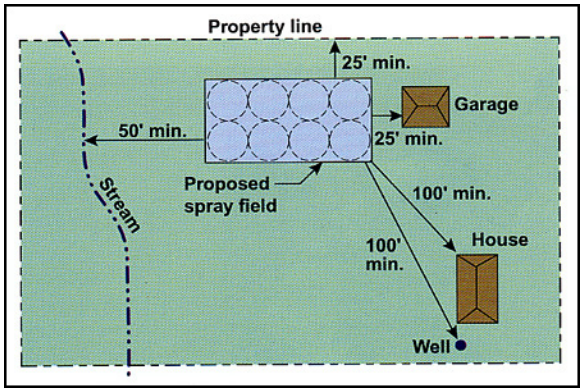

Figure 6.4. Isolation Distances for Spray Fields
Source: SEO Field Manual, Ref. 21

6.3.3 Alternate Individual On-lot Systems

a. Alternate systems shall be considered for individual on-lot systems in any of the following cases:
   i. To solve an existing pollution or public health problem;
   ii. To overcome specific site suitability deficiencies, or as a substitute for systems described in this chapter on suitable lots;
   iii. To overcome specific engineering problems related to the site or its proposed use; or
   iv. To utilize under varying site conditions an experimental design, either in whole or in part, which has been deemed successful by the department.

b. By definition, alternate systems are on-lot systems, so residential systems shall be sized in accordance with chapter 73, section 17 of Reference 1 (current values also provided in Table 6.2). Also refer to chapter 73, section 17 of Reference 1 for sewage flows for other commercial and institutional establishments.

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- Grey water Systems
- At-Grade Bed Systems
- Modified Subsurface Sand Filter for Fast Percolation, Shallow Bedrock Sites with No Water Table Present
- Shallow Placement Pressure Dosed System
- Drip Irrigation System
- Steep Slope Elevated Sand Mound Beds on Slopes Between 12 and 15 percent and Percolation Rates of 3-30 Minutes per Inch
- A/B Soil System (ABS System)
- Non-Infiltration, Evapotranspiration Bed Contained Within a Greenhouse

Alternative On-Lot Technology Research: Soil-Based Treatment Systems (Ref. 15) published by the Delaware Valley College Research and Demonstration Center for On-Lot Systems and Small Flow Technology provides an overview and treatment data for six alternative on-lot wastewater treatment systems that are appropriate for the climate, geology and soil conditions found throughout Pennsylvania. The systems were adjusted conventional systems in an attempt to improve their effectiveness on non-prime agricultural soils. The soil types varied from somewhat poorly drained to well drained and slopes varied from 1 to 24%.

6.4 SMALL FLOW SYSTEMS

If several dwellings, producing not more than two thousand (2,000) gallons per day of wastewater, cannot be connected to a wastewater sewer system, and if site soils are not suitable for a conventional individual or community on-lot wastewater treatment systems, a Small Flow Treatment Facility (SMTF) may be considered.

Small Flow Treatment Facilities consist of the following components:

- Building Sewer

A Small Flow Treatment Facility (SFTF) is intended to serve single-family residences, duplexes and small commercial establishments that generate 2,000 gallons per day or less of domestic wastewater.

The treated effluent from a small flow treatment facility may be discharged to a flowing stream or a

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dry stream channel depending on local site conditions. The final determination of an appropriate discharge location shall be made by a professional knowledgeable in this area, including knowledge of sewage treatment, local soils and geology, hydropedology, hydrology, and other sciences necessary to assess the potential health and safety risk associated with specific discharge points.

According the PA Code, Title 25, Chapter 73 (Ref. 1), the PA DEP recognizes the existence of technologies designed for on-lot wastewater treatment that are not specifically addressed in the regulation, as well as technologies from other disciplines that may be applied to the design or construction of an on-lot wastewater treatment system. Experimental wastewater system permits provide a method for the testing and evaluation of new concepts and technologies applicable to on-lot treatment. Experimental permits may be limited in number on a statewide basis. The PA DEP will determine the number of experimental permits that may be issued for a specific experimental technology or design.

The Experimental On-lot Wastewater Treatment Verification Program (381-2208-001) (Ref. 17) pro-

Recommended Standards

- Treatment Tanks
  - Septic Tank
  - Aerobic Treatment Tank
- Filter Distribution System
- Filtration System
  - Subsurface sand filter
  - Recirculating subsurface sand filter
  - CO-OP RFS III Recirculating Filter
  - Accessible sand filter system
- Disinfection
  - Chlorination
  - Ultraviolet radiation
- Outfall Sewer

The design of Small Flow Treatment Facilities shall be in accordance with standards outlined in the *Small Flow Treatment Facilities Manual* (Reference 16).

6.5 EXPERIMENTAL WASTEWATER TREATMENT SYSTEMS

a. Experimental systems may be considered for individual or community systems in the following cases:

   i. to solve an existing pollution or public health problem.
   ii. to overcome specific site suitability deficiencies, or as a substitute for conventional systems (as listed in Reference 1).
   iii. to overcome specific engineering problems related to the site or its proposed uses.
   iv. to evaluate new concepts or technologies applicable to on-lot disposal/treatment.
   v. to evaluate the applicability to on-lot disposal of established concepts or technologies having successful use as comparable applications in the field of engineering.
   vi. to demonstrate a design having successful use in other jurisdictions under environmental conditions similar to or more restrictive than those in Pennsylvania.
   vii. to utilize, under varying site conditions, an experimental design, either in whole or in part, which has been deemed successful by the PA DEP.

b. By definition, experimental systems are on-lot systems, so experimental residential systems shall be sized in accordance with standards in Reference 1 (PA chapter 73, section 17) or any amendments. Applicable flow rates are provided in Table 6.2. Also refer to Reference 1 (PA Code, chapter 73, section 17), or any updates to same, for sewage flows for other commercial and institutional establishments.

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vides the procedure to evaluate new concepts and technologies in on-lot wastewater treatment.

For updated information from the Water Management Innovative Technology Program, check their web page at http://www.depweb.state.pa.us/watersupply/cwp/view.asp?a=1282&Q=449683&watersupplyNav=| or search for the keyword: Innovative. This site describes how a technology is first tested at a qualified testing center, is moved to field testing, and, if appropriate, is upgraded from an "Experimental" method to an "Alternate" method.

References

References

1. The Pennsylvania Code – Title 25: Environmental Protection, Chapter 71: Administration of Sewage Facilities Planning Program, Chapter 72: Administration of Sewage Facilities Permitting Program and, Chapter 73: Standards for On-lot Sewage Treatment Facilities (available on the web at http://www.pacode.com/secure/data/025/025toc.html).

2. Pennsylvania Department of Environmental Protection e-Library. http://164.156.71.80/WXOD.aspx

3. Pennsylvania Department of Environmental Protection, Act 537: Pennsylvania Sewage Facilities Planning Act, Document Number: 3800-BK-DEP1416, March 2004.

4. Pennsylvania Natural Heritage Program, PNDI Project Planning Environmental Review, http://www.naturalheritage.state.pa.us

5. Federal Emergency Management Agency. Install Sewer Backup Valves. http://www.fema.gov/plan/prevent/howto/how2007.shtm.

6. Pennsylvania Department of Environmental Protection, Domestic Wastewater Facilities Manual, Document ID: 362-0300-001, October 1, 1997 (available on the web at the PA DEP e-Library: http://164.156.71.80/WXOD.aspx).

7. The Dewberry Companies, Land Development Handbook, 2nd Edition, McGraw-Hill, New York, 2002.

8. Gravity Sanitary Sewer Design and Construction, ASCE Manual on Engineering Practice, No. 60, prepared by the Joint Task Force of the American Society of Civil Engineers and the Water Pollution Control Federation, New York, 1982.

9. Melcalf & Eddy, Inc. Wastewater Engineering: Treatment and Reuse, 4th Edition, McGraw-Hill Higher Education, New York, NY, 2003.

10. Gravity Sanitary Sewer Design and Construction, ASCE Manual on Engineering Practice, No. 60, prepared by the Joint Task Force of the American Society of Civil Engineers and the Water Pollution Control Federation, New York, 1982.

11. Metcalf & Eddy, Inc., Wastewater Engineering: Collection and Pumping of Wastewater, McGraw-Hill Book Company, New York, 1981.

12. U.S. Environmental Protection Agency, Handbook for Managing Onsite and Cluster (Decentralized) Wastewater Treatment Systems, EPA No. 832-B-05-001, December 2005 (available on the web at http://cfpub.epa.gov/owm/septic/home.cfm).

13. U.S. Environmental Protection Agency, Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems, EPA 832-B-03-001, March 2003 (available on the web at http://cfpub.epa.gov/owm/septic/home.cfm).

14. Pennsylvania Department of Environmental Protection, Alternate System Guidance, Document Number: 362-0300-007, September 20, 2003 (available on the web at the PA DEP e-Library: http://164.156.71.80/WXOD.aspx).

15. Pennsylvania Department of Environmental Protection, Manual for Land Application of Treated Sewage and Industrial Wastewater, Document Number: 362-2000-009, October 15, 1997 (available on the web at the PA DEP e-Library: http://164.156.71.80/WXOD.aspx).

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16. Hepner, L., D. Linde, C. Weber, and D. Smith. Alternative On-Lot Technology Research: Soil-Based Treatment Systems, Delaware Valley College, Research and Demonstration Center for On-Lot Systems and Small Flow Technology, Doylestown, 2005.

17. Pennsylvania Department of Environmental Protection, Alternate System Guidance, Document Number: 362-0300-007, September 20, 2003 (available on the web at the PA DEP e-Library: http://164.156.71.80/WXOD.aspx).

18. Pennsylvania Department of Environmental Protection, Small Flow Treatment Facilities Manual, Document Number: 362-0300-002, November 22, 2003 (available on the web at the PA DEP e-Library: http://164.156.71.80/WXOD.aspx).

19. Pennsylvania Department of Environmental Protection, Experimental On-lot Wastewater Treatment Verification Program, Document Number: 381-2208-001, July 3, 2004 (available on the web at the PA DEP e-Library: http://164.156.71.80/WXOD.aspx).

20. The Second Class Township Code, Section 2502. Sanitary Sewer Connections. http://www.psats.org/townshipcode/index.html

21. Field Manual for Pennsylvania Sewage Enforcement Officers, Pennsylvania State Association of Townships Supervisors and the Pennsylvania Department of Environmental Protection.

22. Growing Greener: Conservation by Design, Natural Lands Trust, September 2001.

Appendix 6.A Definitions

Appendix 6.A Definitions

Absorption Area -- A component of an individual or community sewage system in which liquid from a treatment tank seeps into the soil; it consists of an aggregate-filled area containing piping for the distribution of liquid and the soil or sand/soil combination located beneath the aggregate.

Alternate Sewage System -- a method of demonstrated on-lot wastewater treatment and disposal not described in the regulations, PA Code, Title 25, chapter 72.

Building Sewer -- In pluming, the extension from the building drain to the public sewer or other place of disposal; also called house connection.

Buried Sand Filter -- A system of piping, sand media, aggregate and collection piping in a buried liner used for the intermittent filtration and biochemical treatment of sewage.

Community Sewage System -- any system, weather publicly or privately owned, for the collection of sewage or industrial wastes of a liquid nature from two or more lots, and the treatment and/or disposal of the sewage or industrial waste on one or more of the lots or at any other site

Conventional Sewage System -- a system employing the use of demonstrated on-lot sewage treatment and disposal technology in a manner specifically recognized by the regulations promulgated under PA Code, Title 25, chapter 72. The term does not include alternate sewage systems or experimental sewage systems.

Dosing Pump -- The pump housed in a dosing tank which provides a measured volume of sewage effluent to the pressurized distribution system in an absorption area.

Equivalent Dwelling Unit -- For the purpose of determining the number of lots in a subdivision only as it relates to the determination of planning exemptions and fees for planning module reviews under this chapter, that part of a multiple family dwelling or commercial or industrial establishment with flows equal to 400 gpd. These flow figures are not intended to be used for the calculation of flows for the design of community sewerage systems or for the allocation of flows related to community sewerage systems. Community sewerage system flows for design and permitting purposes shall be calculated using the procedures established in the Department's Domestic Wastewater Facilities Manual.

Experimental Sewage System -- a method of on-lot sewage treatment and disposal not described in the regulations promulgated under PA Code, Title 25, chapter 72 which is proposed for the purpose of testing and observation.

Filter Tank -- The tank housing the piping and sand of the free access sand filter.

Free Access Sand Filter -- An accessible system of tanks, dose piping, sand media, aggregate and collection piping used for the intermittent filtration and biochemical treatment of sewage.

Geotextile - Material consisting of mesh polypropylene, polyester, nylon or similar material, used to prevent migration of fine aggregate into coarser aggregate.

Appendix 6.A Definitions (cont.)

Individual Residential Spray Irrigation System -- an individual sewage system permitted under Act 537 that serves a single dwelling and that treats and disposes of sewage using a system of piping, treatment tanks and soil renovation through spray irrigation

Individual Sewage System -- a system of piping tanks or other facilities serving a single lot and collecting and disposing of sewage in whole or in part into the soil or into any waters of the Commonwealth of PA or by means of conveyance to another site for final disposal.

Large Volume On-lot Sewage System -- An individual or community on-lot sewage system with a design capacity to discharge subsurface sewage flows that are in excess of 10,000 gpd.

Lateral Sewer -- a sewer that discharges into a branch to the sewer and has no other common sewer tributary to it.

Lift Pump -- A submersible pump used to convey effluent to the sand filter and from the sand filter to the chlorine/retention tank.

Limiting Zone -- A soil horizon or condition in the soil profile or underlying strata that includes one of the following:

(i) A seasonal high water table, whether perched or regional, determined by direct observation of the water table or indicated by soil mottling.
(ii) A rock with open joints, fracture or solution channels, or masses of loose rock fragments, including gravel, with insufficient fine soil to fill the voids between the fragments.
(iii) A rock formation, other stratum or soil condition that is so slowly permeable that it effectively limits downward passage of effluent.

Main Sewer

(1) in larger systems, the principal sewer to which branch sewers and submains are tributary; also called trunk sewer. In small systems, a sewer to which one or more branch sewers are tributary
(2) In pluming, the public sewer to which the house or building sewer is connected

NSF -- National Sanitation Foundation.

Retaining Tank -- A watertight receptacle which receives and retains sewage and is designed and constructed to facilitate ultimate disposal of the sewage at another site. The term includes:

(i) Chemical toilet -- A permanent or portable nonflushing toilet using chemical treatment in the retaining tank for odor control.
(ii) Holding tank -- A tank, whether permanent or temporary, to which sewage is conveyed by a water-carrying system.
(iii) Privy -- A tank designed to receive sewage where water under pressure is not available.
(iv) Incinerating toilet -- A device capable of reducing waste materials to ashes.
(v) Composting toilet -- A device for holding and processing human and organic kitchen waste employing the process of biological degradation through the action of microorganisms to produce a stable, humus-like material.
(vi) Recycling toilet -- A device in which the flushing medium is restored to a condition suitable for reuse in flushing.

Sewage Enforcement Officer -- An official of the local agency who reviews permit applications and sewage facilities planning modules, issues permits as authorized by the act and conducts investigations and inspections that are necessary to implement the act and the regulations thereunder.

Appendix 6.A Definitions (cont.)

Small Flow Treatment Facilities - An individual or community sewerage system designed to adequately treat sewage flows not greater than 2,000 gpd for final disposal using a stream discharge or other disposal methods approved by the department.

Small Flow Treatment Facility -- An individual or community sewerage system designed to adequately treat sewage flows not greater than 2,000 gpd for final disposal using a stream discharge or other methods approved by the department.

Solids Retainer -- A deflection device at the outlet tee or baffle of a septic tank designed to deflect buoyed solids from escaping the tank.

Spray Field -- Piping, spray heads and ground surface to the outside edges of the wetted perimeter, used for the application and treatment of the sewage effluent in an individual residential spray irrigation system.

Treatment tank -- A water-tight tank designed to retain sewage long enough for satisfactory bacterial decomposition of the solids to take place. The term includes the following:

(i) Septic tank -- A treatment tank that provides for anaerobic decomposition of sewage prior to its discharge to an absorption area.

(ii) Aerobic sewage treatment tank -- A mechanically aerated treatment tank that provides aerobic biochemical stabilization of sewage prior to its discharge to an absorption area.

Trunk Sewer -- a sewer that receives many tributary branches and serves a large territory.

Undisturbed soil -- Soil or soil profile, unaltered by removal or other man-induced changes, except for agricultural activities, which would adversely affect the siting or operation of on-lot systems.

Wastewater (or Sewage) -- A substance that contains the waste products or excrement or other discharge from the bodies of human beings or animals and noxious or deleterious substances being harmful or inimical to the public health, or to animal or aquatic life, or to the use of water for domestic water supply or for recreation. The term includes any substance that constitutes pollution under The Clean Streams Law.

Wastewater (or Sewage) Facilities -- A system of sewage collection, conveyance, treatment and disposal that will prevent the discharge of untreated or inadequately treated sewage or other waste into waters of this Commonwealth or otherwise provide for the safe and sanitary treatment and disposal of sewage or other waste. The term includes:

(i) Individual sewage system -- A system of piping, tanks or other facilities serving a single lot and collecting and disposing of sewage in whole or in part into the soil or into waters of this Commonwealth or by means of conveyance to another site for final disposal. The term includes:

(A) Individual on-lot sewage system -- An individual sewage system that uses a system of piping, tanks or other facilities for collecting, treating and disposing of sewage into a soil absorption area or spray field or by retention in a retaining tank.

(B) Individual sewerage system -- An individual sewage system that uses a method of sewage collection, conveyance, treatment and disposal other than renovation in a soil absorption area, or retention in a retaining tank.

(ii) Community sewage system -- A sewage facility, whether publicly or privately owned, for the collection of sewage from two or more lots, or two or more equivalent dwelling units and the treatment or disposal, or both, of the sewage on one or more of the lots or at another site.

(A) Community on-lot sewage system -- A system of piping, tanks or other facilities serving two or more lots and collecting, treating and disposing of sewage into a soil absorption area or retaining tank located on one or more of the lots or at another site.

(B) Community sewerage system -- A publicly or privately owned community sewage system that uses a method of sewage collection,

Appendix 6.B Additional Resources

conveyance, treatment and disposal other than renovation in a soil absorption area, or retention in a retaining tank.

Appendix 6.B Additional Resources

The following documents can be found in the PA DEP e-Library at http:/164.156.71.8D/WXOD.aspx

Administration of Fee Collection for Planning Module Reviews (362-2207-008, 10/2001)
Alternate Systems Guidance (362-0300-007)
Domestic Wastewater Facilities Manual: A Guide for the Preparation of Applications, Reports and Plans (362-0300-001 10/97)
Experimental On-lot Wastewater Technology Verification Program (381-2208-001)
Impact of the Use of Subsurface Disposal Systems on Groundwater Nitrate Nitrogen Levels
Implementation Guidance for Evaluation Wastewater Discharges to Drainage Ditches and Swales (391-2000-014)
Manual for Land Application of Treated Sewage and Industrial Wastewater (362-2000-009, 10/1997)
Small FlowTreatment Facilities Manual (362-0300-002)
Technical Decision Making & the Use of conventional Technology, Alternate Technology, Experimental Technology, and Best Technical Guidance (BTG) in On-lot Sewage System Repair Situations (362-2208-003)
Water Quality Anti-degradation Implementation Guidance (391-0300-002, 11/2003)

Additional information can be found on the PA DEP website at www.dep.state.pa.us, keyword wastewater

National Small Flows Clearinghouse (NSFC) at http://www.nesc.wvu.edu/nsfc/nsfc_index.htm .
The NSFC provide objective information about onsite wastewater collection and treatment systems for communities of fewer than 10,000 people.

National Onsite Demonstration Program (NODP) at http://www.nesc.wvu.edu/nodp/nodp_index.htm
The NODP was developed to encourage the use of alternative, onsite wastewater treatment technologies to protect public health, ensure water quality, and sustain the environment in small and rural communities.

The National Decentralized Water Resources Capacity Development Project (NDWRCDP) at http://www.ndwrcdp.org/
The NDWRCDP's goal is to support research and development to improve our understanding and strengthen the foundations of training and practice in the field of onsite/decentralized wastewater treatment.

Appendix 6.C Sewer Details

Illustration 6-c. Typical Plan View of Manhole

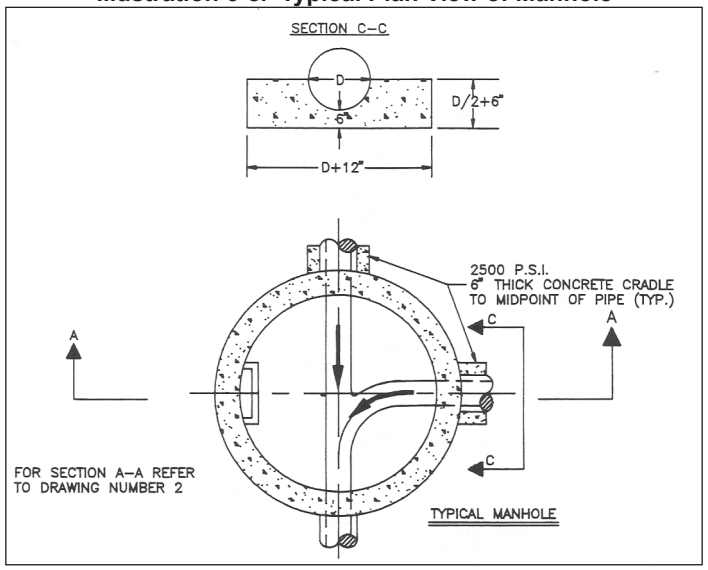


Illustration 6-d. Typical Plan view of Drop Manhole

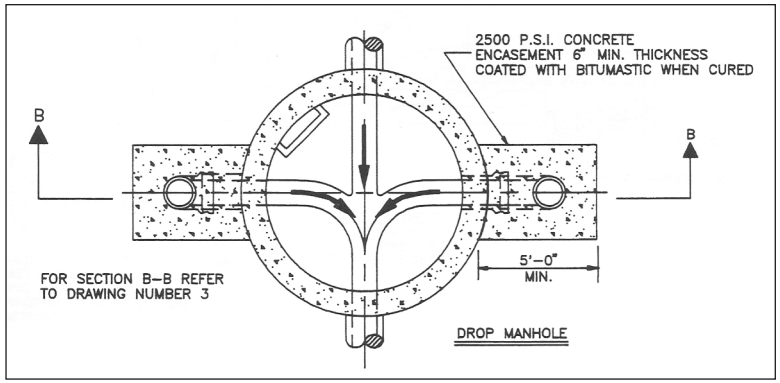


Illustration 6-e Cast-in-place Base/Precast Wall Sections

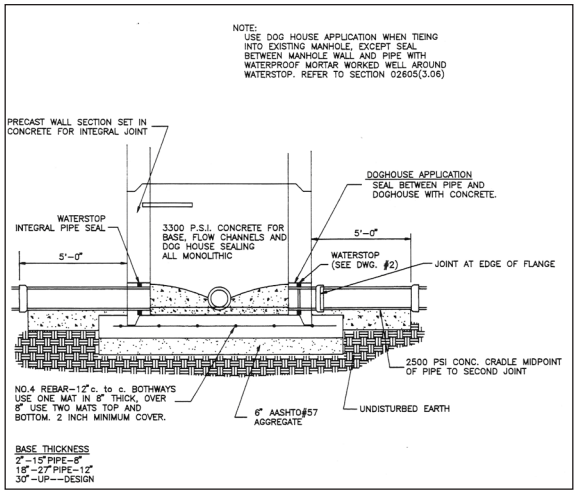
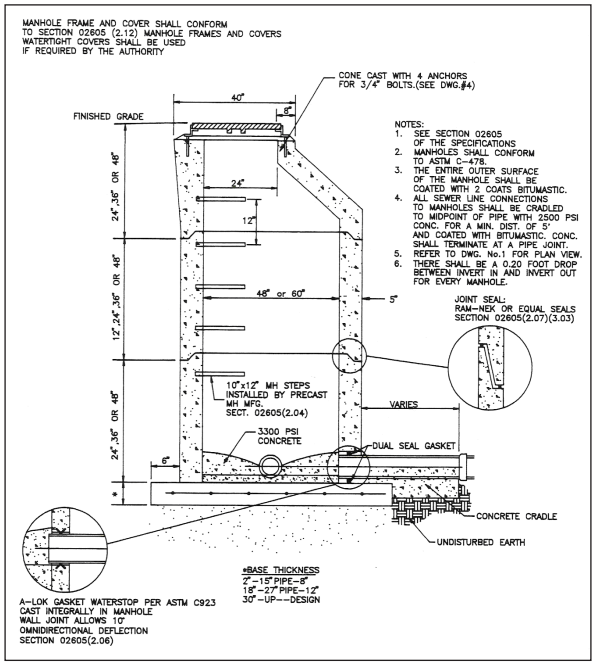


Illustration 6-f. Typical Manhole Showing Precast Base and Wall Sections



Appendix 6.C (cont.)

Illustration 6-g. Drop Manhole Detail

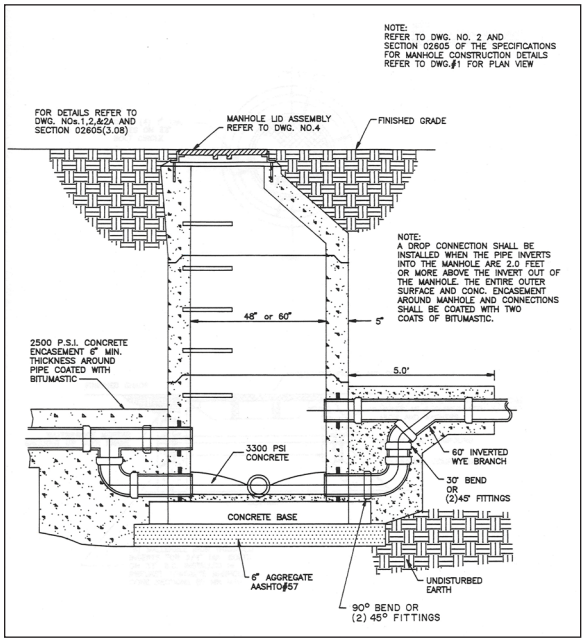


Illustration 6-h. Typical Lateral and Marker

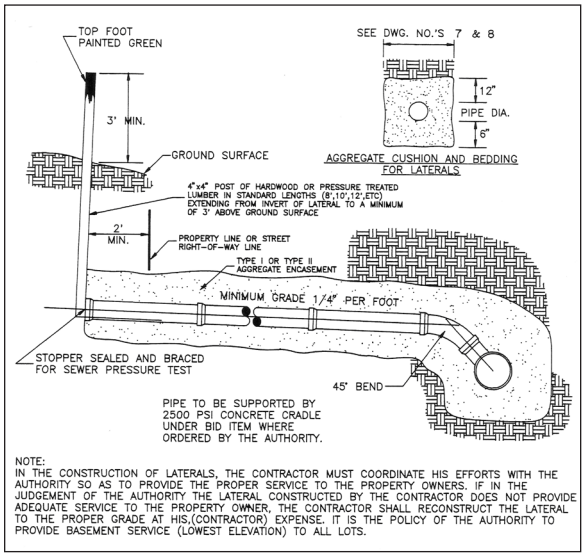
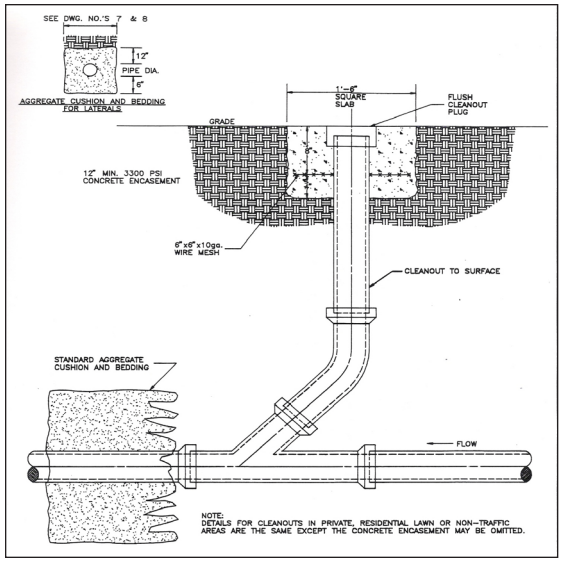


Illustration 6-i. Typical Clean-out Detail



Concrete encasement is only needed when the clean-out is placed in pavement to protect the pipe from cracking. When placed in pavement, the plug should terminate at grade. When the clean-out is located in a yard, consideration should be given to protecting against cracking and inflow and infiltration. Location at grade may lead to increased inflow and infiltration while a higher pipe may be broken during lawn maintenance or cut by homeowners.

Appendix 6.C (cont.)

Illustration 6-j. Typical Clean-out for Private Collection System Parking Lot

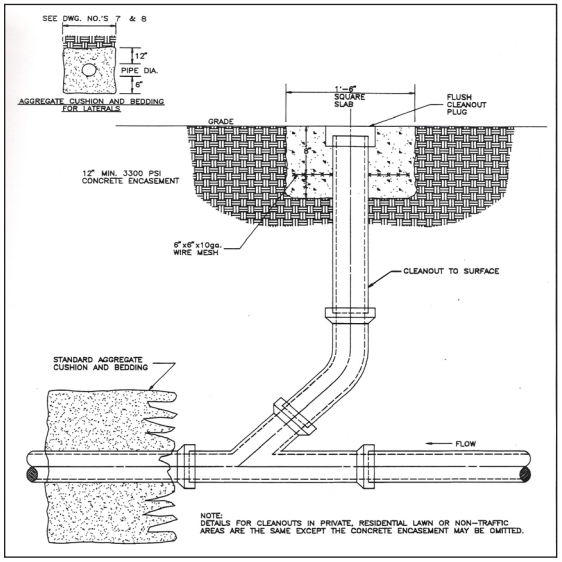


Illustration 6-k. Typical Cleanout Under Street

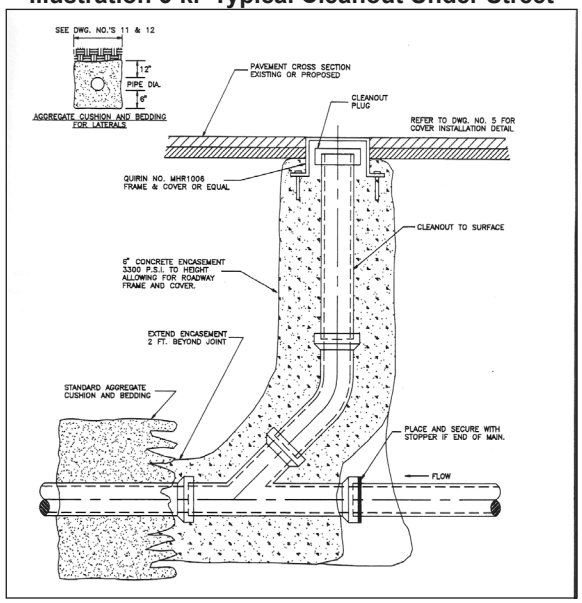
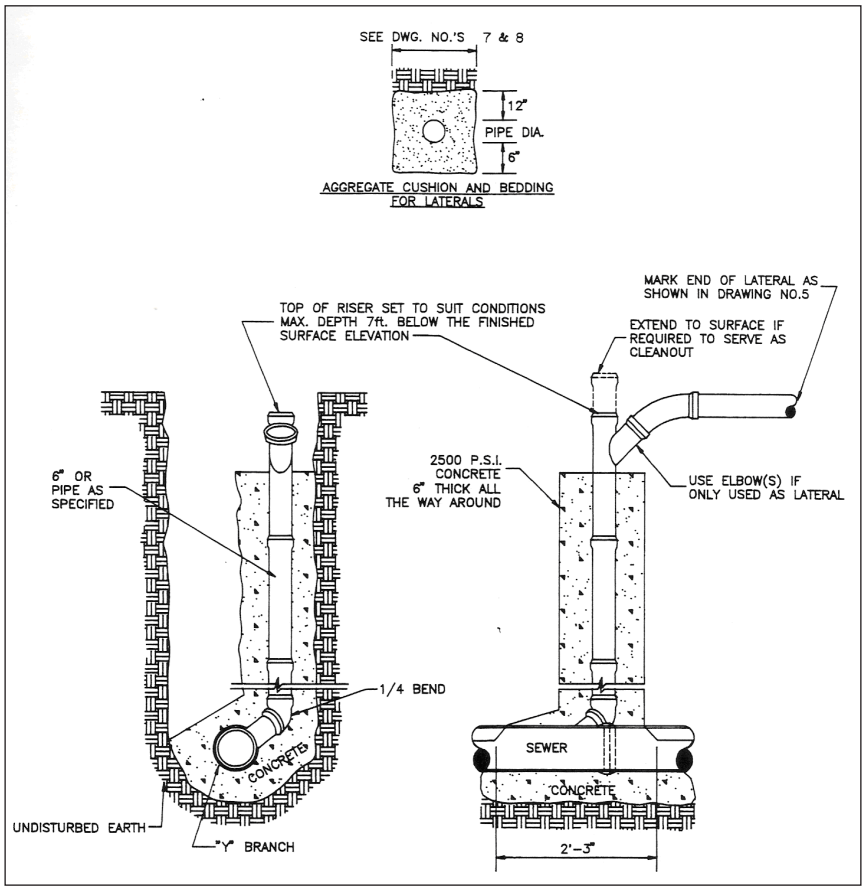
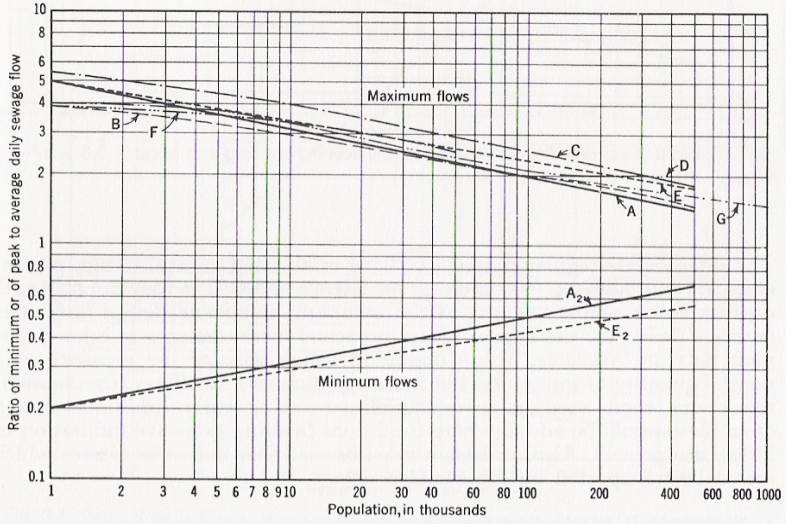


Illustration 6-l. Typical Deep Cut Lateral



Appendix 6.D Peaking Factors for Wastewater Flows

Illustration 6-m. Peaking Factors for Wastewater Flows



* Curve A source: Babbitt, H. E., "Sewerage and Sewage Treatment." 7th Ed., John Wiley & Sons, Inc., New York (1953).
Curve A_2 source: Babbitt, H. E., and Baumann, E. R., "Sewerage and Sewage Treatment." 8th Ed., John Wiley & Sons, Inc., New York (1958).
Curve B source: Harman, W. G., "Forecasting Sewage at Toledo under Dry-Weather Conditions." *Eng. News-Rec.* **80**, 1233 (1918).
Curve C source: Youngstown, Ohio, report.
Curve D source: Maryland State Department of Health curve prepared in 1914. In "Handbook of Applied Hydraulics." 2nd Ed., McGraw-Hill Book Co., New York (1952).
Curve E source: Gifft, H. M., "Estimating Variations in Domsetic Sewage Flows." *Waterworks and Sewerage*, **92**, 175 (1945).
Curve F source: "Manual of Military Construction." Corps of Engineers, United States Army, Washington, D.C.
Curve G source: Fair, G. M., and Geyer, J. C., "Water Supply and Waste-Water Disposal." 1st Ed., John Wiley & Sons, Inc., New York (1954).
Curves A_2, B, and G were constructed as follows:

Curve A_2, $\frac{5}{P^{0.167}}$

Curve B, $\frac{14}{4+\sqrt{P}}+1$

Curve G, $\frac{18+\sqrt{P}}{4+\sqrt{P}}$

in which P equals population in thousands.

Source: ASCE Manual of Practice, Ref. 8