

Sanitary Sewer Design Manual
City of Lancaster
Department of Engineering
Department of Water Pollution Control



May 2001

This Sanitary Sewer Design Guideline is hereby approved

Kent Huston 5/31/01
Kent Huston, City Engineer Date

Michael B. Nixon 5-29-01
Michael B. Nixon, Superintendent Water Pollution Control Date

Earl H. Strawn 6-4-01
Earl H. Strawn, Service-Safety Director Date

PURPOSE

This manual is to provide awareness to the designer of new development in the City of Lancaster of acceptable local design standards. It is a supplement to standard design procedures. This manual is meant to be a guideline for development in the City and as a supplement to the Subdivision Regulations. The City understands that not all projects will conform to these standards and may require unique solutions suited for the individual site. These situations should be addressed early in the planning stages of the development. The latest edition of the City Zoning Ordinances, Subdivision Regulations, Construction and Materials Specifications (CMSL), Standard Drawings and General Notes shall be followed in planning and designing the project.

References to 10 States Standards shall refer to Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers publication Recommended Standards for Wastewater Facilities, 1990 Edition. References to the Ohio EPA Green Book shall refer to the Ohio Environmental Protection Agency publication Sewage Collection, Treatment & Disposal Where Public Sewers Are Not Available, 1993 Edition.

POLICY

TRIBUTARY AREA DETERMINATIONS

Tributary Boundaries

The tributary area for a proposed mainline sanitary sewer shall be clearly defined and shown on the tributary area map. The designer shall research the existing sewer to which a connection is being made and review contour maps and any prior sanitary sewer design information of the area to determine the correct tributary boundary for the proposed mainline sewer.

Changes in sanitary sewer tributary design boundaries may be approved by the City Engineer. Calculations and tributary maps shall be submitted to document the sanitary sewer system capacity to a point downstream determined by the City Engineer.

Development Densities

Development densities have been provided based on local zoning densities and can be found in Appendix A.

Alternate Calculations

Alternate calculations for sanitary sewer flows may be approved on a case-by-case situation by the City Engineer. These cases will generally involve unusual development types or development that in-fills existing service areas beyond the original plan.

DESIGN FLOWS

Flow Calculations

Sanitary sewers shall be designed to handle the flow from the entire tributary area under peak conditions. Flow shall be calculated as the average sanitary flow multiplied by a peak factor and added to the infiltration allowance as follows:

$$Q=(Q_{avg}P)PF+IA$$

Where

Q=Sanitary Flow

Q_{avg} =Average Sanitary Flow=0.0002 cfs/capita

P=Population of Tributary Area based on design density

PF=Peak Factor=3.5

I=Infiltration allowance=0.003 cfs/acre

A=Tributary Area

Alternate Calculations

In special cases, such as industrial or institutional developments, conditions may require alternate methods of calculating sanitary flow. In these cases flow may be calculated based on water use records, sanitary flow records or other means acceptable to the City Engineer.

SANITARY SEWERS

Design Criteria

Sanitary sewers shall be designed to receive sanitary waste from the entire tributary area. Sanitary sewers shall be a minimum of 10 feet deep at the farthest point of the tributary area and shall be designed to serve the basements of all developments unless approved by the City Engineer. Sanitary sewers shall be extended through the property to a point no less than ten-feet from the property line at a location approved by the City Engineer. This shall become the connection point for all upstream tributary areas.

Trench backfill shall be as per the requirements of the City of Lancaster. The maximum cover shall be determined based on the supporting strength of the conduit, as installed, divided by a suitable factor of safety, and must equal or exceed the loads imposed upon it by the weight of earth plus any superimposed loads. Trench dams shall be provided at a point midway between each sanitary manhole and shown on the plans.

Concrete encasement shall be used when required for the sanitary sewer to withstand trench loadings, when rock is encountered in the trench bottom, when cover is less than 30-inches or when such sewer line crosses a stream with a year-round flow.

The design procedure recommended for use in structural design of sewers is the Design Manual Concrete Pipe (available from American Concrete Pipe Association), wide trench installation.

The minimum sanitary sewer size is 8-inches for all mainline sanitary sewers and 6-inches for sanitary service lines. Downstream sewers shall be greater than or equal to the upstream size unless approved by the City Engineer. All new sanitary sewers shall be constructed of vitrified clay pipe for sewers 24-inches and under or concrete pipe for sewer over 24-inches. Sanitary sewers shall be sized using the Manning's equation:

$$V=1.486/n R^{2/3} S^{1/2}$$

Where

V=average velocity (ft/s)

n=Manning's roughness coefficient=0.013

R=hydraulic radius (ft)

S=channel slope (ft/ft)

A Manning's "n" of 0.013 shall be used.

The sanitary sewer shall be designed to insure self-cleaning. The minimum velocity shall be 2 fps. The maximum velocity shall be 15 fps. The size of the sewer must be adequate based on the tributary area to provide the following capacities:

8" through 15" flowing 50% full

18" through 27" flowing 75% full

30" and larger flowing 90% full

In dead end lines not projected to be extended, the slope of the last run of sanitary sewer shall be increased to provide a velocity of 3 fps.

The flow line of pipes should be set such that the invert of the pipes, at junctions have a minimum drop of 0.10 feet; if the outlet elevation permits, the crown of the outlet pipe may be lower. The flow line elevations of sewers should be set to avoid using concrete encasement.

A minimum vertical separation of 18 inches shall be maintained between the sanitary sewer and all water and storm sewer lines. A 10-foot horizontal separation shall be maintained between sanitary sewer and water lines. A 12-inch vertical separation shall be maintained between the sanitary sewer and all other buried utilities. It is the responsibility of the designers to locate all buried utilities to the best of their abilities.

Temporary bulkheads shall be provided at all sanitary sewer stubs for future phases or extensions. Bulkheads shall also be provided on new sanitary sewer lines at the connection to existing sanitary sewers until such time as the lines are inspected, tested and accepted for use. All bulkheads shall be shown on the plans.

Pipe Standards

All sewers shall be constructed of vitrified clay pipe for sewers 24-inches and under or concrete pipe for sewers over 24-inches meeting the requirements of CMSL 901. Alternate materials may be approved by the City Engineer under special design conditions.

Manholes

Manholes shall be designed to meet the standards of the City of Lancaster and/or the Ohio Department of Transportation and located in such a way as to be accessible to City crews. All manholes on new sewers shall be precast type 1, 2 or 3. Manholes constructed on existing sewers shall be cast-in-place type 4.

Drop manholes shall be required where there is more than two-feet difference in the incoming and outgoing sewer. Outside drop connections shall be used on all new manholes. No more than one inside drop connection will be allowed in each manhole. Where the difference in elevation between the incoming sewer and the outgoing sewer is less than 24-inches, the invert shall be filleted to prevent solids deposition.

Precast concrete modular units shall be in accordance with the applicable standard drawing or as approved by the City Engineer. Precast bases shall be placed on a foundation as noted on the standard drawings, a minimum of 3-inches of compacted sand, or as approved by the City Engineer. The compacted foundation shall be leveled to provide a uniform support for the entire area of the base.

All joints between modules shall be in conformance with ASTM C443, 706.10 or 706.11. Sanitary manholes shall be watertight. Manholes shall be vacuum tested in accordance with ASTM C1244 prior to backfilling. Manholes that fail the vacuum test shall be repaired or replaced by the developer. After the manhole is backfilled, the City Engineer may require additional testing if there is an indication that the water tightness has been compromised.

Pipe entrances to the precast modular sections shall be in accordance with 706.15 or neatly grouted in place.

All lift holes and other openings in the structure shall be thoroughly and neatly grouted with cement mortar or other suitable material approved by the City Engineer, after all pipes are placed into the structures.

Where corrosive conditions due to septicity, industrial wastes or other causes are anticipated, consideration shall be given to providing corrosion protection on the interior of the manholes.

Frames and castings shall be in accordance with the applicable standard drawing or as approved by the City Engineer and shall be set in a mortar bed at the locations and elevations specified.

Cleanouts will not be permitted on mainline sewers. Manholes shall be located at points in the sanitary sewer where the following occur

Junctions of Pipes

Change in Direction

Change in Slope

Change in Pipe Size

End of Pipe Run

Maximum Spacing 300 feet for pipe up to 18 inches-400 feet for pipe over 18 inches.

Manholes shall be located outside ponding areas, swales, flood routes or protected to the 100-year storm. Manholes located in floodplains shall have a top of casting elevation 2 feet above the 100-year flood elevation. Chimney Seals shall be required on all manholes. Bolt down lids will be required in floodplains and other locations as determined by the Superintendent of Water Pollution Control.

Stream and Ditch Relationships

Sewers crossing open channels shall be designed to cross as nearly perpendicular to the channel as possible and be free from change in grade. Whenever possible, the number of these crossings shall be minimized to mitigate the amount of sediment pollution produced by construction.

The minimum cover for sewers at stream crossings shall be 4-feet unless concrete encased. Trench backfill will be in accordance with Item 911 of the CMSL. Watercourse erosion protection shall be placed over top of the backfill trench. A detail of the stream crossing will be provided on the plan. The plans shall note that erosion control shall be constructed within 48 hour after utility construction is complete.

Sewers that parallel an open channel shall be located outside of the streambed and sufficiently removed to provide for future possible stream widening and to prevent pollution by siltation during construction.

Service Lines

Sanitary service wyes shall be installed at the time the sanitary sewer is constructed at locations indicated on the plans. Wyes shall not be laid flat. All wyes shall be shown on the plans and located by sanitary sewer station.

Sanitary service laterals shall be extended at the time the sanitary sewer is constructed to all proposed lots or users in the development. Laterals shall be extended to the right-of-way line or beyond any proposed utilities which ever is farther. A minimum of 2 feet of service lateral is required. Plans shall show the location, length, slope and end of service invert for all service lines.

No service connection will be allowed into the sanitary manholes unless approved by the City Engineer. All service laterals shall be located on the property line unless topography or site conditions warrant a different location. Double laterals will be allowed in single and multi-

family developments but shall be centered on the lot line and located a minimum of two feet apart.

Services shall be constructed per the City of Lancaster Standard Drawing. The minimum slope shall be 1.0%. Cleanouts shall be provided on all services over 100 feet in length at a minimum spacing of 100 feet. Risers at the mainline may be required when the end of the service will be greater than ten feet below existing or proposed ground elevations. Unless approved by the Superintendent of Water Pollution Control, no service lateral shall be reused unless it tested for water tightness in accordance with CMSL 901.20.

Trench dams shall be installed on all service lines on the property owner's side of the right-of-way line.

Bedding and backfill requirements for sanitary services shall be the same as for sanitary sewers.

Basement Service

Sanitary sewers shall be deep enough to provide service to the basement level without basement flooding due to a sewer surcharges. Surcharge levels shall be determined by a four foot surcharge in the downstream manhole. In general, basement connections will not be allowed where the end of service elevation is less than 10 feet below the building pad elevation. Where basement service is not allowed, the sanitary plans and the grading plans will be marked "First Floor Discharge Only".

Clean Water Connections

Roof drains, foundation drains and other clean water connections to the sanitary sewer system are prohibited in the City of Lancaster.

Field Tiles

Field tiles and spring drains encountered during construction shall be connected to the stormwater system in accordance with the City of Lancaster Standard Drawings.

Easements

Sanitary sewers shall be located in the public street whenever possible. Sanitary sewers located outside the public right-of-way shall be provided with an easement for maintenance and repair. A specifically located and described, 20 feet minimum width access easement shall be required from the maintenance easement to the nearest public right-of-way. Maintenance and access easements are to be kept free of obstructions. Additional easements may be required for sanitary sewers that are located in the public right-of-way if necessary to provide room for maintenance and repair activities. Easements descriptions and exhibits shall be submitted for all required easements not recorded with a plat.

Protection of Water Supplies

The City of Lancaster has established a Wellhead Protection area. Sanitary sewers constructed within this area may require special materials and/or testing. Determination of special requirements for location and construction of sanitary sewers in the Wellhead Protection area shall be done by the City Engineer.

Pump Stations, Grinder Pumps and Individual System

Only under circumstances of extreme hardship shall sewer pump stations, grinder pumps or individual household sewage disposal systems be permitted. These systems shall be designed in accordance with City of Lancaster Pump Station design standards, 10 States Standards or the Ohio EPA Green Book. The designer shall meet with the City Engineer to discuss these designs.

Industrial Wastes and Pretreatment Requirements

The design of the sanitary sewers shall incorporate all materials and facilities required by the Water Pollution Control Department for protection of the sanitary sewer system and the monitoring of industrial wastes. The designer shall contact the Water Pollution Control Department for their requirements.

EROSION AND SEDIMENTATION CONTROL

Construction activities required as part of land development necessitate the removal of natural ground cover, creating the potential for erosion to occur. Erosion, and the movement of the soil off the site and into the stormwater control system, can lead to water quality impacts. Excessive soil in the stormwater system can also cause the system to malfunction or require excessive maintenance to keep the system operational. Proper erosion control techniques can minimize the loss of soil on the site.

An erosion and sediment control plan shall be required for all sanitary sewer construction. For sanitary sewers that are not part of an overall development that includes stormwater management may meet this requirement by referring to the overall erosion and sedimentation control plan.

Policy

The policy of the City of Lancaster that no person shall cause or allow earth-disturbing on a development prior to submittal and approval of an erosion and sediment control plan showing compliance with the City standards.

Design Criteria

Permanent control provisions shall be coordinated with the temporary erosion control to the extent possible to assure economical, effective and continuous erosion control throughout the construction and post-construction period.

Perimeter control and other sediment trapping measures shall be installed to stop the movement of sedimentation off the site. Such controls will include: stabilized construction entrances, straw

bale dams and fabric fencing, temporary sediment traps, sediment basins and diversions. Storm drains, both on and off the site, shall be protected from sedimentation. Stormwater retention or detention facilities shall not be used as sedimentation traps without the approval of the City Engineer. Any facilities are used as a sedimentation trap or sedimentation basin for construction activities shall be thoroughly cleaned of all sedimentation and returned to full design capacity prior to the release of the construction bond.

Construction shall be scheduled to minimize the amount of area disturbed at any one time. Disturbed areas that are at finish grade shall be permanently seeded within seven days. Other areas of disturbed soil shall be rough graded to provide drainage and temporarily seeded if they are to remain dormant for more than 30 days.

Slope protection shall be provided by use of temporary and permanent diversion dikes, vegetative cover and slope drains. Concentrated stormwater flows shall not be allowed to flow down cut or fill slopes without proper slope stabilization.

Concentrated stormwater runoff leaving a development site shall be outletted to an open channel, storm sewer inlet or culvert, which is capable of receiving the discharge. Runoff velocities shall be controlled to prevent erosion.

Appropriate measures shall be taken to minimize or eliminate wastes, unused building materials, and all pollutants from being carried from the site by runoff. Proper storage, handling and use of all potentially polluting substances shall be employed.

Public and private roadways shall be kept cleared of accumulated sediment. Provisions for proper dust control may be required as deemed necessary.

Where construction crosses a stream or channel, a temporary stream crossing will be needed.

Erosion Control design shall meet or exceed the requirements of the City of Lancaster Standard Drawings and Standard Notes.

Maintenance During Construction

All disturbed areas that are exposed to precipitation; structural control measures and locations of vehicle entrance and exit shall be inspected by the developer at least once every seven days and within twenty-four hours of a storm event greater than 0.5 inches. Inspection shall be continued until all disturbed areas are stabilized; structural controls are removed or converted to stormwater management facilities. Corrective action will be taken for all noted deficiencies. Such actions shall be initiated within 24-hours of inspection notification.

Sediment deposits shall be removed from straw bale and filter fence barriers upon reaching approximately one-half the height of the barrier at its lowest point or causes a silt fence to bulge and should be deposited at a controlled fill area.

Sediment deposits shall be removed from diversion channels, dikes, outlet channels and stabilized areas after every rainfall. Any area damaged by erosion shall be repaired and reseeded within 24-hours or as soon as the soil dries sufficiently to allow work to proceed.

Temporary stream crossings shall be inspected after every rainfall and at least weekly for assessment of damage due to stormwater flows or construction equipment. Necessary repairs shall be made within 24-hours or as soon as the soil dries sufficiently to allow work to proceed.

The City maintains the right to inspect any site of land disturbance at any reasonable time and to require compliance with regulations and soil erosion control plan.

DESIGN SUBMISSION

Plans

Construction plans shall be submitted on archive quality mylar with the City title block. Mylar or a disk with the title block in AutoCAD format is available through the City Engineering Department. Text size should be no less than 0.08 inch. A set of construction drawings should contain the following sheets as applicable:

1. Cover/Title Sheet
2. General Notes Sheets
3. Street Plan view and Profile Sheets
4. Detention/Retention Basin Sheets
5. Storm Sewer Profile Sheets
6. Sanitary Plan view and Profile Sheets
7. Grading Plan Sheets
8. Erosion and Sediment Control Plan Sheets
9. Street Lighting Sheets
10. Turn Lane / Berm and Ditch Improvement Sheets
11. Street Cross Section Sheets
12. Signage and Striping Plans
13. Maintenance of Traffic Plans

Plans for sanitary sewers may be submitted separately to allow for earlier approvals and start of construction. This should only be done with the knowledge that revisions and field adjustments may be needed once street plans are approved. It is the responsibility of the designer to coordinate any changes between the sanitary plans and the street, water, storm and grading plans.

In the case of large developments or phased developments, a master utility plan may be required.

The master utility plan shall show the proposed layout of all utilities for the entire project including connections to the existing systems.

The minimum construction plan requirements shall be:

I. Cover Sheet

1. Vicinity Map
2. Bench Marks
3. Estimate of Quantities
4. List of applicable Standard Drawings
5. List of applicable General Notes
6. Any required Special Notes
7. Ohio Professional Engineer's signature
8. Owner/Developer's signature to agree with intent of plans
9. Index/Overall tributary area map at a 1" = 200' scale
10. OUPS symbol and phone number
11. Any special details required for construction of the proposed sewer

II. General Notes Sheet

1. These sheets should contain a listing of the current General Notes that apply to the specific plans. The note number and note should be shown in numerical order. Additional notes that apply to the project may also be shown here.

III. Plan view Guidelines

1. North Arrow shall be pointing either to the top or to the left of the sheet
2. Scale shall be no less than 1" = 50'
3. Proposed work shall be the heaviest line weight on the sheet
4. All new structures shall be located by dimensions or station offsets and numbered
5. All new mains shall be located by bearings and distances
6. The proposed sanitary sewer line will be stationed increasing from the downstream connection to the farthest most end of the sanitary line.

The sanitary sewer shall not be stationed from the street centerline.

7. If any match lines are required, they shall be at even 100-foot stations
8. Label all adjacent property owners
9. Label pavement replacement type and location, if required
10. Show all existing utilities as dashed lines and label type and size
11. Note type of pipe that is to be used
12. Note type of bedding that is to be used
13. Label location where tunneling or steel casing pipe is to be used, especially under streams and railroads, if required

IV. Profile Guidelines

1. Scales shall be a minimum 1" = 50' horizontal and 1" = 5' vertical
2. Stationing and numbering of proposed sewer and structures shall match plan view
3. Show and label all proposed and existing utility crossings including water service line and street crossings
4. Label proposed structure types and stationing with regards to the sewer
5. Label sewer pipe with respect to type, size, length and slope
6. Show any existing features as a dashed line type and label with an existing drawing number
7. Show special backfill limits with appropriate stationing
8. Show and label existing and proposed ground surfaces which are to be cut along centerline of sewer
9. Label elevations of stubs or bricked openings in manholes that are for future use
10. Temporary or permanent bulkheads
11. For plan clarity only one utility shall be shown on the street profile. This utility will be the utility that most parallels the centerline of the street and will generally be the water line. If needed and approved the gas line may also be shown on the street profile. All other profiles shall be shown as separate drawings.

V. Erosion and Sediment Control Plan Guidelines

1. Scale shall not be less than 1" = 100'
2. Site layout
3. Proposed control measures in the heaviest line weight on the page
4. Legend for the drawing
5. Any special notes required
6. Flood routing information
7. Erosion and Sedimentation Control Narrative including
 - a. Name and Address of Owner or Operator
 - b. Facility Name and Address
 - c. Type of Facility
 - d. Name of Receiving Water
 - e. Description of Project
 - f. Estimated Timetable
 - g. Acres to be Disturbed
 - h. Location and Type of Construction Activity
 - i. Map of Site
 - j. Proposed measures to control stormwater pollution
 - k. Existing site conditions
 - Soils
 - Land use
 - Areas of Concern

Calculations

Appropriate calculations to document and justify the engineering design of the project shall be submitted for review. The calculations shall be stamped by the design engineer. A partial list of calculations is given below. Not all of these calculations may apply to every project.

Service Area Density Calculations-Showing density of development for tributary area (required)

Storm Sewer Design Calculations-Indicating drainage to and capacity of storm sewers (required)

Downstream Capacity Calculations-Verifying capacity of downstream systems (required)

Pump Station Sizing Calculations-Showing design and sizing of Pump Station (if applicable)

Other Calculations

Tributary Map

A tributary map showing all areas to be served by the proposed sanitary system shall be provided. The map shall be no smaller than 1"=100' and include both upstream and downstream areas tributary to the sanitary system and the point of connections. All proposed sanitary facilities shall be shown with the appropriate tributary boundaries for each structure.

APPENDIX A
Sanitary Densities for various land uses.

City of Lancaster
Sanitary Sewer Density

Existing Zoning Code

Zoning	Use	Units/Acre	People/Unit	People/Acre
A	Single Family	4	3	12
A	Single Family	2	3	6
A	Single Family	1	3	3
B-1	Multi-Family	26	2.5	65
B-2	Multi-Family	10	2.5	25
B-3	Multi-Family	10	2.5	25
C-1	Commercial	12	1.5	18
C-2	Commercial	12	1.5	18
C-3	Commercial-Filling Stations			16
D	Light Industrial			*
E	Heavy Industrial			*
F	Mobile Home	6	2.5	15

* Flow to be determined based on individual Site. Where no information is available use 1000 gal/ac/day for Light Industrial and 3000 gal/ac/day for Heavy Industrial.

Enacted Zoning Code

Zoning	Use	Units/Acre	People/Unit	People/Acre
AG	Agricultural	0.5	3	1.5
RE	Residential Estate	2	3	6
RS-1	Residential Low Density	3	3	9
RS-2	Residential Medium Density	5	3	15
RS-3	Residential High Density	6	3	18
RS-4	Residential Highest Density	9	3	27
RD	Residential Duplex	7	3	21
RM-0	Residential Multifamily Lowest Density	15	2.5	37.5
RM-1	Residential Multifamily Low Density	25	2.5	62.5
RM-2	Residential Multifamily Medium Density	25	2.5	62.5
RM-3	Residential Multifamily High Density	45	2.5	112.5
RMH	Residential Manufactured Home	8	2.5	20
OL	Office Low Density			10
OM	Office Medium Density			10
OMH	Office Medium High Density			10
OH	Office High Density	8	2.5	20
CN	Commercial Neighborhood			10
CG	Commercial General			10
CH	Commercial High Intensity			10
CBD	Central Business District			10
SR	Scientific Research & Development			*
IL	Industrial Low Density			*
IM	Industrial Medium Density			*
IH	Industrial High Density			*
PUD	Planned Unit Development	8	3	24

* Flow to be determined based on individual Site. Where no information is available use 1000 gal/ac/day for Scientific Research and Low Density Industrial, 1500 gal/ac/day for Medium Density Industrial, and 3000 gal/ac/day for High Density Industrial.

Appendix B

Standard Forms

Appendix C

Contact Numbers

Contact Numbers

Engineering Department

Lancaster Municipal Building

104 East Main Street

Lancaster, Ohio 43130

Phone: (740) 687-6614

Fax: (740) 681-5030

Gas Department

1570 E. Main Street

Lancaster, Ohio 43130

Phone: (740) 687-6670

Fax: (740) 687-6672

Street Department

440 S. Maple Street

Lancaster, Ohio 43130

Phone: (740) 687-6668

Fax: (740) 687-6694

Water Department

225 N. Memorial Drive

Lancaster, Ohio 43130

Phone: (740) 687-6630

Fax: (740) 687-6638

Water Pollution Control Facility

800 Lawrence Street

Lancaster, Ohio 43130

Phone: (740) 687-6664

Fax: (740) 687-6667