

**CITY OF ROCHESTER HILLS**  
**ENGINEERING DESIGN STANDARDS**

**CHAPTER 3**

**Sanitary Sewer System**

A. Plans and Specifications - Submittal Procedure

1. The plans and specifications shall be submitted in accordance with ~~section~~ **Chapter 1, General Requirements and Submittals**.

B. Plans and Specifications – Design Considerations; General

1. All sanitary sewer designs shall be developed conforming to the current edition of “Recommended Standards for Wastewater Facilities”, Published by Health Education Services, also known as the “Ten State Standards”.
2. Prior to starting any sanitary sewer design, the applicant is encouraged to make use of maps and information available at the City offices. It shall be the responsibility of the applicant to field check and verify utility locations provided by the City.
3. Reference ~~Section~~ **Chapter 1, General Requirements and Submittals** for specific requirements pertaining to the presentation of plans.
4. ~~A cover sheet shall show, in addition to those items required in *General Requirements and Submittals*, the following:~~
  - a. ~~A location map, sanitary sewer quantities table (including size), legend, permit sheet~~
  - b. ~~Overall layout of the sewer system with manhole numbers and direction of flow arrows. Existing and proposed sewers shall be shown with different symbols and line types.~~
  - c. ~~Quantities and sizes of the proposed sewer to be constructed.~~
  - d. ~~A flow calculation for the service area, and any future service area that may be ultimately served by the proposed sewer.~~
4. **An overall utility layout sheet shall include the following:**
  - a. **Basis of Design for the service area, and any future service area that may be ultimately served by the proposed sewer. Include interceptor sewer sub-district.**
  - b. **Overall layout of the sewer system with manhole numbers, pipe sizes and direction-of-flow arrows. Existing and proposed sewers shall be shown with different symbols and line types. Direction-of-flow arrows will only be required on larger projects with multiple sewer runs.**

C. Plan and Profile Sheets

1. The Plan portion of the sheet shall include, at a minimum, the following:
  - a. Existing topography and all existing or planned surface or underground improvements in streets or easements in which sewer construction is proposed, or in contiguous areas if pertinent to design and construction.
  - b. Street names, street and easement widths, and all other street and easement survey information, including subdivision names, lot numbers and lot dimensions, **and existing addresses.**
  - c. Location, length, **and size** ~~and direction of flow~~ of each section of the proposed sewer between manholes.
  - d. Locations of all manholes and other sewer appurtenances and special structures.
  - e. ~~Building sewers or wye branches~~ **Sanitary sewer leads** are to be constructed or installed concurrently with sewer construction, with locations **at two feet (2') beyond** easement and/or property lines.
2. The Profile portion of the sheet shall appear below the companion plan portion, generally projected vertically, and shall show at a minimum the following:
  - a. Size, slope, type and class of pipe, and controlling invert elevations for each section of proposed sewer between manholes.
  - b. Limits of special backfill requirements.
    - i. Locations and limits of Class II sand backfill, where required.
    - ii. Class of bedding material.
    - iii. **Backfill requirements will be in accordance with MDOT Standard Details.**
  - c. Location of existing or proposed utilities crossing the line of the sewer or otherwise affecting sewer construction.
  - d. Location, by station, of every proposed manhole, with manhole number, invert elevation of all inlet or outlet pipes, top of casting elevation, and manhole type.
  - e. Length of run between manholes (400 feet maximum).
  - f. Location, by station from downstream manhole, of all ~~building sewers or wye branches~~ **sanitary sewer leads**, to be constructed or installed concurrently with the proposed sewer construction.
  - g. Existing and proposed ground elevation above the route of the sewer.
  - h. Provide a minimum depth from top of curb (or road centerline if uncurbed) to the top of any sanitary sewer of ten feet (10') at local control points, or a minimum of ten

feet (10') at locations where the sewer grade is parallel to the road grade. Under any design the sewer shall be deep enough to reasonably serve, by gravity, a standard depth basement.

- i. Required risers, with control elevations.
- j. Invert elevation at property line for ~~building sewers~~ **sanitary sewer leads** to be included with sewer construction.
- k. Manholes shall be identified by numbers assigned consecutively and increasing in direction opposite to direction of flow in each sewer.
- l. All elevations shall be on U.S.G.S. ~~d~~Datum.
- m. Reference benchmarks, established at intervals not greater than 1200 feet and convenient to the proposed construction, shall be noted on the Plan and Profile Sheets, with identification, location, description and established elevation listed.
- n. Each Plan and Profile Sheet shall include a tabulated list of quantities of construction pay items appearing on those sheets, with a total quantity list on the coversheet.

#### D. Location of Sanitary Sewers

1. Sanitary sewers shall generally be located on opposite sides of streets from water mains, eight feet (8') from the back of the curb on the southerly and westerly side of the street.
2. Generally, sanitary sewers shall be installed in a public street right-of-way or in easements exclusively reserved for such use.
3. Easements for sanitary sewers shall have a minimum width of twenty feet (20'), centered upon the sewer. Such easements shall be deeded or dedicated to the City of Rochester Hills, with restrictions against use or occupation of easements, by the property owners and/or by other utilities, in any manner which would restrict sewer maintenance or repair operations.
4. Easements for possible extensions shall be provided to the property lines at locations designated by the City Engineer.
5. Sewers shall preferably be constructed outside of paved parking areas, streets and drives.
6. Sewers shall be installed parallel to the property lines, or building lines, with clearance distances to accommodate the full width of the proposed easement.
7. Sanitary sewers shall maintain ten foot (10') of horizontal separation from all parallel utilities.
8. Sanitary sewer crossings of other utilities shall have a minimum vertical clearance of eighteen inches (18"), with the sanitary sewer placed below the other utility.

E. Bedding

1. Sewer pipe shall be placed on Class "B" bedding or better, as indicated on the sewer detail sheet.

F. Drop Connections

1. **Precast** external drop connections are required at manholes where the invert of the outlet pipe is eighteen inches (18") or more below the invert of the inlet pipe.
2. Internal drop connections are not allowed unless specifically approved by the City Engineer.

G. Tunneling and Boring

1. Where conditions require tunneling or boring, consult the City Engineer for specific requirements. Where sanitary sewers or sanitary sewer leads cross improved roads of any type, the pipe shall normally be installed by tunneling or boring, located within a steel casing pipe.

H. Extensions and Future Connections

1. Where the sanitary sewer must be extended from off-site, sanitary sewer leads extending two feet (2') beyond the property line of all adjacent property, on both sides of the right-of-way, the entire length of the off-site sanitary sewer installation, shall be provided.

I. Minimum Pipe Size

1. Minimum pipe size for sanitary sewers shall be eight inches (8") nominal internal diameter.
2. Minimum pipe size for sanitary leads shall be six inches (6") nominal internal diameter.

J. Sanitary Sewer Materials

1. The following materials may be used for public sanitary sewer construction, approved pipe materials must conform to standards adopted by the Office of the Oakland County Drain Commissioner:
  - a. For sewers eight inches (18") to fifteen inches (15"):
    - i. **ABS PVC Truss** pipe, ASTM D-2680, with ~~solvent-welded~~ **gasketed** joints, **ASTM D-3212**.
    - ii. Other types of pipe as approved by the City Engineer.
  - b. For six inch (6") sewer leads:
    - i. Six inch (6") leads shall be ~~solid-walled ABS~~ **PVC SDR 23.5 or PVC Sch 40, both solid walled. Gasketed or solvent-weld joints are acceptable.** Pipe shall

have a minimum pipe stiffness of 150 p.s.i., and a minimum deflection of fifteen percent (15%) at failure. The sewer lead material shall be compatible with sewer main material.

- c. For Sewers greater than fifteen inches (15"):
  - i. Reinforced Concrete Pipe (RCP) shall conform to the current ASTM D C76, wall B. Joints shall be synthetic rubber and meet or exceed the requirements established by ASTM C361.

K. Backfill

- 1. Trench backfill shall be MDOT approved Class II sand under all **proposed and existing** paved areas, roads, streets, drives, pathways and sidewalks, or within the one-on-one (1-on-1) influence of the road. Sand shall be compacted to ninety-five percent (95%) maximum density.

L. Manhole Locations

- 1. Manholes shall be constructed at every change in sewer grade, alignment and pipe size, and at the end of each sewer line. Maximum distance between manholes shall not exceed 400 feet.
- 2. Manholes shall be constructed of precast reinforced concrete sections.
- 3. Where future connections to a manhole are anticipated, stubs or blind external drop connections, with watertight bulkheads, shall be provided.
- 4. Monitoring manholes shall be required for connections associated with non-domestic uses or as required by the City Engineer.
- 5. **Consideration shall be given to installation of grease/oil separators during design where applicable.**

M. Allowable Pipe Slopes

Pipe Diameter (inches)	Minimum Slope (feet per 100 feet)	Maximum Slope (feet per 100 feet)
8	0.40	8.36
10	0.28	6.22
12	0.22	4.88
15	0.15	3.62
18	0.12	2.84
21	0.10	2.32
24	0.080	1.94
27	0.067	1.66
30	0.058	1.44
36	0.046	1.14

N. Hydraulic Calculations

1. Calculations

- a. Gravity sanitary sewers, Manning's Formula, with  $n=0.013$  shall be used.
- b. Low-pressure sewer systems and force mains, the Hazen-Williams formula with  $C=120$  shall be used.

2. Minimum and Maximum Velocities

Minimum design velocities for gravity and low-pressure sanitary sewers shall be two feet (2') per second, and a maximum design velocity shall be ten feet (10') per second, with pipe flowing full. The slope of the sewer between the last two manholes at the upper end of any gravity sewer lateral shall be increased above one percent (1%) to obtain cleansing velocity.

O. Allowances for Changes in Pipe Size

1. Maximum flow velocity for full pipe flow shall be maintained by continuity of the 0.80 diameter depth above invert for pipe size increases and also with intersecting sewer grade raised to compensate for head loss due to direction change.
2. ~~Provide a drop of 0.10 feet in the downstream sewer invert for all manholes, to compensate for velocity head loss of the incoming flow.~~

P. ~~Building Sewers~~ Sanitary Sewer Leads

1. Unless otherwise approved by the City Engineer, construction of ~~building sewers~~ sanitary sewer leads from the public sewer to a point two feet (2) beyond the easement and/or property line, for each fronting parcel, which the sewer is designed to serve, shall be included with the construction of each sanitary sewer.
2. Where construction of ~~building sewers~~ sanitary sewer leads to the property line is not required concurrently with sanitary sewer construction, a wye branch with riser, if required, and with water-tight stopper or plug with type of joint used for the sewer pipe, shall be installed for every lot or building site which the sewer is designed to serve.
3. Where depth of sewer from top of pipe to finished surface exceeds ten feet (10'), risers shall be installed from wyes ~~and tees~~ to an elevation ten feet (10') below finished surface. Additional riser height will be required when the observed ground water level during construction is above ten feet (10') with a minimum of four feet (4') of cover.
4. Minimum size for ~~building sewers~~ sanitary sewer leads shall be six-inch (6") nominal internal diameter. Each structure shall have a separate individual sanitary service lead connected to a public sanitary sewer.

5. Minimum slope for building sewers shall be one-percent (1%).
6. Sanitary sewer leads shall not be connected directly into manholes unless approved by the City Engineer.

Q. Sewer Capacity Design

1. Tributary Area

- a. Sanitary sewers shall be designed to serve all naturally tributary areas, with due consideration given to topography, the master sanitary sewer plan, established zoning, and the adopted City Master Land Use Plan.

2. Population

- a. For design purposes, population shall be based on a minimum of three and a half (3.5) persons per detached single-family home site (or equivalent single family unit), and two and a half (2.5) persons for each multiple-family dwelling unit (1,200 S.F. or less).
- b. Submissions for review shall include a tabulation of occupancy (usage) types and the conversion of these into terms of equivalent single-family units. The area of the site, in acres, may be used to calculate dwelling units based on density allowed in the Zoning Ordinance. The adopted most current unit assignment factors as published by the Office of the Oakland County Drain Commissioner shall be used to convert the different usage types to equivalent single-family units.

~~3. Sewage Quantities for Pipe Design~~

- ~~a. For service areas with design populations of 500 or less, sewer design flows shall be 400 gallons per capita per day, as specified under the Ten State Standards of GLUMRB.~~
- ~~b. For service areas with design populations greater than 500 but less than 28,400 sewer design capacity shall be based on the following formula:~~

~~$$Q_{\text{peak}} = \frac{100 \times 18 + (P)^{1/2}}{4 + (P)^{-1/2}}$$~~

~~— where;  $Q_{\text{peak}}$  = Peak design flow in gallons per capita per day~~

~~— P = Design population expressed in thousands~~

- ~~c. For service areas with design populations exceeding 28,400, sewer design capacity shall be 250 gallons per capita per day, as specified by GLUMRB.~~

### 3. Design Criteria

- a. To determine the daily average flow (gal /day), a factor of one-hundred (100) gal per capita per day as specified in the Recommended Standards for Wastewater Facilities (known as the Ten State Standards) as determined by the GLUMRB shall be utilized.
- b. To determine the peak flow (gal per day), the peaking factor (PF) will be calculated by using the following formula as specified in the Recommended Standards for Wastewater Facilities.

$$PF = \frac{18 + (P)^{1/2}}{4 + (P)^{1/2}}, \text{ P, design population expressed in thousands}$$

- c. The peaking factor shall not be less than 2.5 or exceed 4.0.

### R. Acceptance of Utilities

#### 1. Preliminary Acceptance

- a. Prior to acceptance, all sanitary sewers shall be flushed and cleaned in accordance with City Standards.
- b. Air Test or Infiltration Test shall be completed in accordance with the current Standards of the Office of the Oakland County Drain Commissioner.
- c. Televising: Prior to acceptance of new sanitary systems, a televised inspection of ~~each~~ every section of the sewer shall be conducted from manhole to manhole. A videotape of this inspection shall be submitted to the City Engineer for review and approval prior to acceptance. The sewer shall be flooded prior televising.
- d. The Engineer shall make first submittal of ~~record~~ as-built drawings, which must include rims, inverts, pipe size, and slopes.

#### 2. Final Acceptance

- a. Approved Mylar ~~record~~ as-built drawings shall be submitted to the City prior to final acceptance of the sanitary sewer.
- b. Final Acceptance is based on a two-year maintenance inspection. This shall include a televised inspection, at the city's expense, of every section of the sanitary sewer from manhole (MH) to manhole (MH). This shall be witnessed by the City inspector and a copy of the video-tape must be given to the City Engineer prior to final acceptance. If a problem is found, the city has the ability to use the maintenance bond to have the developer pay for expense of second televising.

### S. Permit Acquisition

1. Nine (9) sets of plans need to be submitted to the City; along with a completed MDEQ Part 41 permit application for request of issuance of sanitary sewer construction permit.
2. An OCDC sanitary sewer tap permit is required unless the sanitary sewer is private or a service lead.

T. Private Sewers

1. Private owners are permitted only if one legal owner is connected to the system. If parcel development is possible, private systems will not be permitted.
2. Private sanitary sewer materials and construction to be in accordance with all of the above standards.