

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

**CHAPTER 2**

**Water Distribution System**

A. Plans and Specifications – Submittal Procedure

1. The plans and specifications shall be submitted in accordance with *Chapter 1, General Requirements and Submittals*.
2. The Applicant may proceed with water main permitting once the City has conducted an initial review of the entire construction plan submittal and all revisions pertaining to the water main have been completed. The Applicant shall supply nine (9) sets of plans to the City for distribution to the Great Lakes Water Authority (GLWA) for approval, and forwarding to the Michigan Department of Environment, Great Lakes & Energy (EGLE) for approval and an EGLE construction permit. After, a copy of the approved permit will be provided to the applicant.

B. Plans and Specifications – Design Considerations; General

1. All water systems shall be designed conforming to the current edition of the “Recommended Standards for Water Works”, published by Health Education Services, also known as the “Ten State Standards”.
2. Plans shall consist of a cover sheet showing a plan view of the complete job, (split plan and profile sheets are required for water main sixteen inches (16”) and greater), and the City’s standard detail sheets.
3. Reference *Chapter 1, General Requirements and Submittal* for specific requirements pertaining to the presentation of plans.
4. The cover sheet shall contain a total quantity listing of the proposed water main improvements, indicating the lengths of pipe, type of pipe, and their respective sizes.
5. Provide continuous stationing. Identify all existing and proposed tees, valves, bends, hydrants, etc.

C. Benchmarks and Elevations

1. All elevations shall be on U.S.G.S. Datum.
2. Reference benchmarks, established at intervals not greater than 1,200 feet and convenient to the proposed construction, shall be noted on the plan and profile sheets, with identification, location, description and established elevation listed.

3. Street names and widths, subdivision names, lot numbers, addresses, legend, list of quantities, and other pertinent information (including proposed finish grade elevations at hydrants and gate wells) shall be shown on the plans.

D. Soil Conditions

1. Exploratory borings shall be provided by the developer, if requested by the City. Boring logs shall be indicated on the plans, if required.
2. Water main design, relative to pipe bedding and location, shall reflect the proper selection of materials and construction method compatible with the field conditions. Areas which show unsatisfactory ground material for pipe bearing, or possible chemical deterioration due to soils, shall be avoided or the pipe shall be suitably installed on adequately designed bedding and/or enclosed in protective wrap or coating.
3. Sand or other approved porous material shall be required for the full depth of trenches under all driveways and parking areas (private or commercial), streets, alleys, pathways and sidewalks.

E. Location and Layout

1. The distribution system in all developments requiring more than 600 feet of water main shall have a minimum of two (2) connections to a source of supply, and shall be a “looped” system on separate mains, if possible. If the looped system comes off the same water main, an isolation valve between the connection points is required.
2. Generally, water mains shall be installed in a public street right-of-way or in easements exclusively reserved for such use on the opposite side of the street from sanitary sewers. All easements shall be a minimum of twenty feet (20’) wide and shall be dedicated to the City of Rochester Hills.
3. Water main shall be installed parallel to the property lines, or building lines, with clearance distances to allow for a twenty-foot (20’) wide easement centered on the water main.
4. Preferably, water main should be constructed outside of paved parking areas, streets, and drives.
5. In new developments water mains shall be installed from boundary to boundary in abutting roads and interior streets, and at other locations as may be deemed necessary by the City, for future extensions.
6. All water mains shall be installed with a minimum cover of six feet (6’) below finish grade. When water mains must dip to pass under a storm sewer or sanitary sewer, the sections, which are deeper than normal shall be kept to a minimum length by the use of vertical 45 degree (45°) - 11¼ degree (11¼°) bends properly anchored with thrust blocks and restrained joints, as approved by the City Engineer.
7. Open Drain Crossings:  
At all open drain crossings, a separate enlarged scale view is required. A minimum of four-foot (4’) clearance or as required by the Michigan Department of Environment, Great Lakes & Energy between the bottom of the drain and the top of the water main is required.

8. **Connections to Existing Main:**  
When connecting to an existing water main, a tapping sleeve, valve and well are required. Same size taps are **not** allowed. In this case, a cut-in-tee with an in-line gate valve and well is required. A full body sleeve is required for all taps made to ductile iron, cast iron, or PVC water main, or as directed by the City Engineer.
9. **Finish Grades:**  
The plans shall indicate the finish grades of all hydrants and gate well rims.
10. **Horizontal Clearance:**  
All water mains shall be located so as to provide a minimum of ten feet (10') horizontal clearance between the nearest edge of the water main and the nearest edge of any sanitary or storm sewer.
11. **Vertical Clearance:**  
A minimum vertical clearance of eighteen inches (18") shall be maintained between the bottom of any water main and the top of any sanitary sewer, or any other utility, crossing under the water main. Vertical clearance of less than eighteen inches (18") or crossing of a sewer over a water main will require the encasement of the sewer or for special measures to be taken to prevent contamination of the water supply. Details must be submitted with the plans for review and approval by the City Engineer. Class II sand compacted to ninety-five percent (95%) maximum density shall be used at all utility crossings in twelve inch (12") compacted lifts, to the top of the highest utility.
12. **Tunneling:**  
Where conditions require tunneling or boring, consult the City Engineer for specific requirements. These conditions may include road crossings or conflicts with trees, shrubs, structures, or other utilities. Where water mains cross an improved road of any type, the pipe shall be installed by tunneling or boring and be placed in a steel casing pipe, or as directed by the City Engineer.
13. **Profiles:**  
Profile view is required for sixteen inch (16") and larger water mains, and for other smaller sizes when determined necessary by the City Engineer. Water mains shall be kept on one side of the street for the entire length of the street. Water mains shall **not** be located under pavement.

F. Easements

1. Easements for possible extensions or looped connections shall be extended to the property line, at locations designated by the City Engineer.
2. The easement descriptions shall include the hydrant leads and shall extend a minimum of ten feet (10') beyond the hydrant on any lead. The easement documents shall contain a provision prohibiting the construction of, or locating of, any above ground structures within the limits of such easements.

G. Pipe Sizes

1. Eight-inch (8") diameter mains are the minimum size to be installed in single-family residential areas.

2. Twelve-inch (12") mains are considered to be the minimum size in commercial, office, industrial, and multiple family residential areas, except in a looped system of 1,500 feet or less where eight-inch (8") mains may be permitted, if approved by the City Engineer.
3. All single-hydrant lead longer than seventy-five feet (75') must be a minimum of eight inches (8") in diameter.
4. Water mains are to be looped whenever possible.
5. Ninety degree (90°) bends are not permitted.

#### H. Pipe Materials and Connections

1. Water mains sixteen inches (16") in diameter or less shall be cement-lined, ductile iron pipe Class 54. An alternate of zinc coated ductile iron Class 52 pipe will be considered and is subject to approval by the City Engineer on a case-by-case basis.
2. Water mains larger than sixteen inches (16") in diameter may be either ductile iron, or concrete lined cylinder pipe, conforming to AWWA C301, as determined by the City Engineer.
3. All ductile iron pipe shall be encased with a loose polyethylene wrap in tube or sheet form of 8 mils minimum thickness per the requirements of ANSI / ASTM standard specification D1248 and AWWA C105.
4. Crosses shall not be allowed, unless specifically approved by the City Engineer.

#### I. Valves – Location

1. A valve shall be provided at every connection to existing mains, unless otherwise approved by the City Engineer.
2. In general, valves on cross connecting mains shall be arranged so that no single line failure will require more than 800 feet of main to be out of service. Valves shall be so arranged that any section can be isolated by closing not more than four (4) valves.
3. A valve shall be provided on every dead-end line where required for future extension, at a location approved by the City Engineer.
4. Valves shall generally be located far enough back from the intersection of street rights-of-way lines for the gate well structure to clear crosswalks.
5. Sufficient valves shall be placed such that not more than twenty-four (24) homes, thirty (30) multiple family units, or two (2) hydrants shall be out of service within such section of water main, which can be isolated.
6. Where possible, gate valves shall be located at street intersections seven feet (7') from the intersecting street right-of-way line. All dead-end mains must include a valve at the tee. Valves should not be located under roadway pavement, pathways, sidewalks, or driveway approaches whenever possible.

J. Valves – Materials

1. Resilient Wedge or Resilient Seated type gate valves (East Jordan or U.S. Pipe) are required.
2. Valves shall be ‘Left Hand Open’ type.

K. Pressure Reducing Valves (PRV’s)

1. In systems where two (2) or more pressure districts are to be connected for a “looped” supply, the plans shall include a PRV near the point of connection to the higher pressure district, to balance pressure across the new water system
2. A line gate valve shall be installed both upstream and downstream of each PRV to permit isolation of the PRV for maintenance or repair. If an alternative service (“looped” supply) to the water system is not available to permit repair on the PRV without a complete shutdown of the system, then a bypass line of equivalent size pipe as the water main and an additional bypass gate valve and well shall be provided.

L. Gate Wells

1. All valves shall be constructed within a gate well, as specified in the Standard Details for water mains.
2. A valve-in-box shall not be constructed unless specifically authorized by the City Engineer.

M. Fire Hydrants

1. In general, residential dwellings shall not be more than 250 feet from a fire hydrant, as measured along the street right-of-way line.
2. The Rochester Hills Fire Department will also review and approve the total number and location of fire hydrants for proposed developments based on building construction type and available pressure in the water system. For information regarding the number of hydrants and spacing, see part R.2., in this section.
3. A hydrant shall be installed at the end of every dead-end main. Temporary blow-offs may be allowed at the end of dead-end mains when future extension is imminent, as approved by the City Engineer.
4. In general, hydrants shall be located in the road right-of-way nine feet (9’) from the right-of-way line, but not closer than six feet (6’) to the back of curb. The location of hydrants with respect to the right-of-way line shall be indicated on the plans. Hydrant valves shall face the road, and hydrants shall be plumb and set to grade prior to final acceptance.
5. Hydrants, not located within a public road right-of-way, shall be located a minimum of five feet (5’) from the edge of pavement or protected by bollards per City Detail Sheets.
6. A six-inch (6”) gate valve with a three (3) piece cast iron valve box, and five and a quarter inch (5¼”) diameter screw shaft, shall be placed forty-two inches (42”) from the centerline of the valve to the centerline of the hydrant, at each hydrant.

7. Hydrants shall be as specified on the City Detail Sheets.

N. Pipe Restraints

1. Restraining glands shall be installed at all bends, dead ends, tees, and hydrants. Installation of thrust blocks is not permitted unless it is placed to supplement or provide redundancy to a restrained joint.
2. Vertical bends that exceed eleven and a quarter degrees ( $11\frac{1}{4}^{\circ}$ ) shall be restrained with rods.

O. Services

1. Service lines are to be shown to all buildings, or each unit in a multi-tenant buildings, other than single-family detached dwellings.
2. Service lines shall be installed using K soft copper or 200 p.s.i. SDR-9 poly pipe. Tracer wire shall be required for any water service built on private property.
3. A valve-in-box for each service line shall be provided and located at five feet (5') from the edge of non-residential buildings.
4. The basis of design for size shall be considered using a flow rate of twenty (20) gpm per residential dwelling unit. The basis of size other than for residential use shall be determined by the developer's Engineer and submitted for approval by the City prior to submittal of final plans.

P. Fire Protection Lines

1. Fire protection lines, where applicable, are to be shown to all buildings.
2. A valve-in-box for each fire protection line shall be provided and located at five feet (5') from the edge of the building.
3. The domestic supply lead shall tee off from the fire protection line, prior to the valve-in-box. The valve-in-box shall be located five feet (5') from the building. A separate domestic supply lead is also acceptable.

Q. Design Geometry

1. Piping Arrangement:  
Any water main in excess of 1,600 feet in length between interconnections may be required by the City Engineer to be oversized. On dead ends where there is no possibility of a future extension a main may not exceed 600 feet in length. Where a dead end exceeds 600 feet in length, the developer will be required to extend the main to provide a loop or oversize the main, as directed by the Engineer. Dead-end mains shall not connect to a looping main of smaller size without City Engineer approval. Hydrants shall be installed at the end of all dead-end water mains.

2. Design Pressures:  
Pipe shall be sized to carry maximum day flow plus fire flow with minimum pressures at any hydrant of twenty (20) psi.

R. Fire flow design criteria:

1. The number of hydrants and spacing is determined by the currently adopted Fire Prevention Code (2006 International Fire Code). See tables B105.1 and C105.1 below.  
Water flow requirements may be increased or decreased based on individual circumstances. Please contact the City of Rochester Hills Fire Prevention Bureau, 248.656.4717, if further information is needed.
2. Design calculations, including hydrant flow tests and/or a simulated hydraulic analysis, shall be furnished upon request of the City Engineer to confirm that pressure is available.

**TABLE B105.1**

**MINIMUM REQUIRED FIRE-FLOW FOR BUILDINGS**

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute)
Type IA IB	Type IIA and IIIA	Type IV and V-A	Type IIB and IIIB	Type V-B	
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000
		115,801-125,500	83,701-90,600	51,501-55,700	6,250
		125,501-135,500	90,601-97,900	55,701-60,200	6,500
		135,501-145,800	97,901-106,800	60,201-64,800	6,750
		145,801-156,700	106,801-113,200	64,801-69,600	7,000
		156,701-167,900	113,201-121,300	69,601-74,600	7,250
		167,901-179,400	121,301-129,600	74,601-79,800	7,500
		179,401-191,400	129,601-138,300	79,801-85,100	7,750
		191,401-Greater	138,301-Greater	85,101-Greater	8,000

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<b>TABLE C105.1</b>			
<b>NUMBER AND DISTRIBUTION OF FIRE HYDRANTS</b>			
<b>FIRE-FLOW REQUIREMENT (gpm)</b>	<b>MINIMUM NUMBER OF HYDRANTS</b>	<b>AVERAGE SPACING BETWEEN HYDRANTS (feet)</b>	<b>MAXIMUM DISTANCE FROM ANY POINT ON STREET OR ROAD FRONTAGE TO A HYDRANT</b>
1,750 or less	1	500	250
2,000-2,250	2	450	225
2,500	3	450	225
3,000	3	400	225
3,500-4,000	4	350	210
4,500-5,000	5	300	180
5,500	6	300	180
6,000	6	250	150
6,500-7,000	7	250	150
7,500 or more	8 or more	200	120

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S. Acceptance of Utilities

1. Preliminary Acceptance

- a. The installed mains must pass all required pressure tests and bacteriological tests as required by current City Standards, prior to the final connections.
- b. Prior to acceptance, water mains shall be flushed in accordance with City Standards. This consists of flowing all hydrants installed with the project.
- c. All structures must be clean and free of construction debris.
- d. The Engineer shall make first submittal of record drawings, which must include rim elevations, pipe size, and tie downs to all water main appurtenances.

2. Final Acceptance

- a. Approved as-built drawings shall be submitted to the City prior to final acceptance of the water main. The as-built set format shall be provided to the City as a PDF (Portable Document Format) version.
- b. Final Acceptance is based on a two (2) year maintenance inspection.