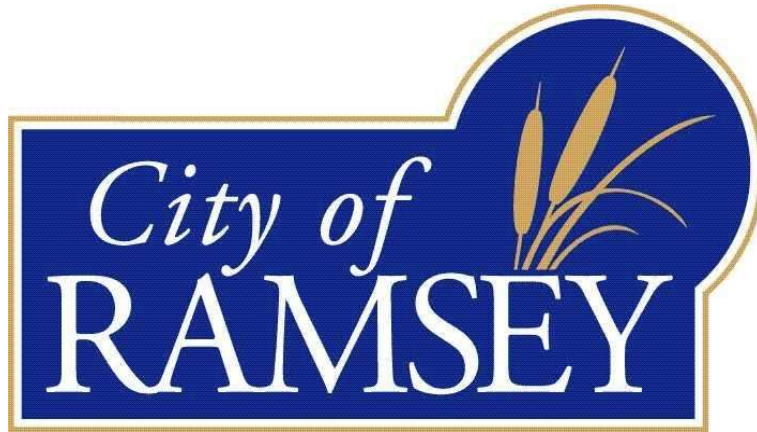




ENGINEERING DESIGN STANDARDS

City of Ramsey
Revised 02/05/2024

This document summarizes the City of Ramsey’s Engineering design standards. Further detail of City of Ramsey design standards can be found in City of Ramsey Standard Details, Standard Specifications, and City Codes. The City of Ramsey follows the most recent edition of the Minnesota Department of Transportation “Standard Specifications for Construction”, Minnesota Statute 8820 and the most recent edition of the City Engineers Association of Minnesota (CEAM) Standard Specifications.

Table of Contents

ENGINEERING PLANS	4
STREETS.....	5
Pavement.....	5
Minimum Pavement Section.....	5
Intersection.....	5
Boulevard.....	6
Concrete Curb and Gutter.....	6
Pedestrian Facilities	6
Concrete Sidewalks.....	6
Bituminous Trail	7
Pedestrian Curb Ramps.....	7
Street Lighting Plan	7
Miscellaneous Design.....	8
Vertical Grades.....	8
Horizontal Curve Minimum Radius.....	8
Right of Way (R1 Zone Classification)	8
Construction Staking.....	9
Private Streets (R2 Zone Classification)	9
Parking Lots.....	9
Driveways	9
Geotechnical	10
Retaining Walls.....	10
SANITARY SEWER	11
Trunk and Lateral Pipes.....	11
Minimum Trunk and Lateral Pipe Slope.....	11
Testing.....	12
Air Test Method	12
Deflection Test.....	12

Tracer Wire Testing	12
Manholes.....	13
Services	13
WATERMAIN	15
Trunk and Lateral Pipes.....	15
Testing.....	16
Hydrostatic Pressure.....	16
Electrical Conductivity.....	16
Tracer Wire Testing	16
Disinfection of Watermain.....	16
Valves	17
Fittings	17
Hydrants.....	17
Services	18
Thrust Blocks.....	19
STORM SEWER	20
Pipe	20
Catch Basins and Manholes.....	20
Ponding	21
Rip Rap	21
Design	21
Testing.....	22
Tracer Wire Testing	22
Methodologies	23
Manning's Roughness (n) for Pipes	23
Runoff Coefficients for Rational Formula.....	23

ENGINEERING PLANS

Engineering plans prepared for streets that will be owned and maintained by the City shall be prepared using black and grey scale line work.

Refer to City of Ramsey Engineering Plan Requirements for detailed plan design requirements.

STREETS

Pavement

Width (Rural)	24'
Width (Urban)	32' BOC to BOC
Width (MSA)	Follow MSA Design Standards
Cul-de-sacs	100' diameter BOC to BOC
Temporary Cul-de-sacs	90' diameter BOC to BOC
Maximum Cul-de-sac street length	600'

Minimum Pavement Section

Bituminous Wear Course (SP 9.5 Wearing Course Mixture SPWEA340C)	1.5"
Utility castings cannot be raised more than 24 hours before paving.	
Bituminous Base Course (SP 12.5 Non-Wearing Course Mixture SPNWB330C)	2.0"
Modified Class 5 Aggregate Base	6.0"

Class 5 Aggregate Base shall be modified per City of Ramsey Standard Detail No. STR26.

Pavement section may be required to be increased and bituminous mixture may need to be altered based upon existing subbase conditions and projected future traffic levels.

Subgrade must be approved granular

Intersection

Angle	Minimum 75°
90° intersection preferred as measured 100 feet from the intersection.	
Intersections of more than four (4) corners are prohibited.	
Tangent (thoroughfare and collector)	Minimum 100' between reverse curves
Tangent (all other streets)	Minimum 50' between reverse curves
Radius (rural)	Minimum 30'
Radius (urban)	Minimum 20'
Radius (alley)	Minimum 10'

Boulevard

Width.....5' minimum, 8' preferred

Minimum Slope 2%

Certificate of survey required for lots with less than 2% slope, minimum grade 1%.

Maximum Slope..... 4 Horizontal : 1 Vertical

TopsoilMinimum 4" in all disturbed areas

Topsoil is defined as black dirt composed of unconsolidated material, largely undecomposed organic matter which is suitable for vegetative growth. The composition of topsoil should contain no more than thirty-five percent (35%) sand content.

SoddingRequired in all disturbed boulevard areas.

Alternate seeding methods may be used in areas not adjacent to the roadway upon Engineering Department approval.

Concrete Curb and Gutter

New Development Surmountable

Type B618 type curb to be used around radii and to transition to catch basin curb box.

Type B618 curb may be used with City Engineer's approval if driveway locations are known.

See City of Ramsey Standard Detail No. STR-1.

Pedestrian Facilities

Concrete Sidewalks

Width..... 6'

Section..... 6" thick unreinforced

Placed on approved subgrade.

Finish..... Broom finish

Joints Place a crack control, ¼" radius trowel joint, at 6' intervals

Maximum 100' spacing between expansion joints. ½" expansion joint must meet MnDOT Specification 3702.

Private Utility Conduit Placed Under Sidewalk

Coordinate utility crossing locations with private utility owners prior to placing concrete sidewalk.

Bituminous Trail

Width..... 10' (12' for Maintenance Trail)

Section.....City Standard Plate No. PARK-1

2.5" Type SP 12.5 Wearing Course Mixture (SPWEA340C) (3.5" in two lifts for Maintenance Trail).

4" Modified Class 5 Aggregate Base per City Standard Plate STR-26.

Select Granular Borrow (as required).

Geotextile Fabric (as required).

Pedestrian Curb Ramps

Pedestrian curb ramps must follow current MnDOT Pedestrian Curb Ramp Details, MnDOT Standard Plan 5-297.250 (6 sheets).

All pedestrian curb ramps require a detail showing; ramp length, slope, gutter spot elevations at zero height curb, full height curb, and mid ramp. Truncated domes must be provided, radial truncated domes shall be used on radial curb ramps.

Street Lighting Plan

Light Size Design Public Streets

Intersections 25' LED light

Along streets 400 feet or more between intersections 25' or 14' LED light

Sharp curve and other unsafe sight obstructions..... 25' or 14' LED light

Cul-de-sac (case by case basis)..... 25' LED light

Light Size Design Public Sidewalks and Trails

Crosswalks on public streets 14' LED light

Along sidewalks and trails (case by case basis)..... 14' LED light

Along desolate or wooded locations (case by case basis)..... 14' LED light

Spacing Factors (case by case)

The proximity to vehicular traffic, projected vehicular and pedestrian traffic volumes and similar items will influence spacing.

Connexus Energy standard designs

25' LED lights..... Low Profile

14' LED lights.....Traditionaire

Design Process

The developer will be responsible for providing a street lighting layout to the City for review before sending the layout to Connexus Energy.

Miscellaneous Design

Crowned Road Cross-slope.....2% minimum

Vertical Grades

Minor and Collector.....0.4% minimum, 7.0% maximum

Arterial0.4% minimum, 4.0% maximum

Intersection (within 30 feet)..... 3.0% maximum

Minimum Vertical Curve.....100 feet or 20 times algebraic difference

State Aid roads must follow MnDOT State Aid Vertical Curve Design Charts.

Horizontal Curve Minimum Radius

Minor..... 100'

Collector and Arterial 310'

Collector and Arterial w/superelevation 240'

Street Jog Offsets

Minor and Service..... 150'

Collector..... 300'

Right of Way (R1 Zone Classification)

State & County Highways 120'

Except where specified otherwise in City Comprehensive Plan.

Collector (MSA) 80'

Rural Residential (Minor)..... 66'

Urban Residential (Minor)..... 60'

Cul-de-sac (Urban) 60' radius

Cul-de-sac (Rural)..... 65' radius

Service 60'

Construction Staking

Cut Sheets and Staking Notes Provided prior to work

Station and cuts / fills must be marked on lath by staking crew. Offset distance must be sufficient to protect lath from construction and will vary depending upon depth of trench.

Private Streets (R2 Zone Classification)

Width (No Parking Permitted) 24' BOC to BOC

Width (Parking Permitted One Side) 28' BOC to BOC

Width (Parking Both Sides) 32' BOC to BOC

Width (Parking Aisle) 24' BOC to BOC

Length (No Turnaround) Maximum 200'

Length (Turning Provision) Maximum 300'

Length (Cul-de-sac) Maximum 600'

Cul-de-sac width must be 32' back to back where the cul-de-sac length is greater than 300'.

Parking Lots

Required Parking Stalls City Code Section 177-356

Contact City of Ramsey Planning Department for details.

<u>Parking Angle</u>	<u>Stall Width</u>	<u>Stall Depth</u>	<u>Aisle Width</u>
90°	9'	18'	24'
60°	9'	17'	17'
45°	9'	19'	11'

Surface Concrete or Bituminous with concrete curb and gutter

Setbacks Minimum 20' from rights of way

Driveways

Width (R1 Zone Classification) Maximum 30', Cul-de-sac 24'

Width (R2 Zone Classification) Maximum 20'

Width (R3 Zone Classification) Maximum 20'

Drive access angle to street Minimum 75°

Surface (Urban) Bituminous or Concrete

Surface (Rural) Bituminous, Concrete, or Class V Aggregate

Geotechnical

Submission..... Submitted with Pre Plat Soil Boring

Spacing..... Roadway Maximum 400'

A soil boring is required in all infiltration areas and all septic field areas.

Depth..... Minimum 10'

Infiltration areas, minimum depth 15' or to a minimum 5' below bottom of infiltration basin.

Retaining Walls

All proprietary wall designs greater than 4' in height (including buried section) in public right-of-way or drainage and utility easements shall contain the following geometric and project specific information:

1. List of acceptable wall types and/or systems for each wall on the project.

2. Drainage

Proprietary designed walls shall include a drainage system consisting of perforated pipe per MnDOT 3245 wrapped with a type I geotextile per MnDOT 3733. The pipe shall be placed such that water drains freely from the pipe, typically a 1% grade and 3-foot minimum radius bends. Provide outlets as required due to expected flow rate with a maximum spacing of 150 feet.

3. Geometrics

a. Beginning and end of wall stations.

b. Top of wall profile.

c. Original and proposed ground line profiles in front of and behind the retaining wall.

Profiles shall show all existing and proposed infrastructure (i.e., utilities and others existing or proposed structures) in the profile section.

d. Cross sections at relevant wall locations. Cross sections shall show temporary and permanent Right-Of-Way (ROW) easement limits and existing utilities.

e. Plan view(s) of wall alignment showing ROW limits, existing and proposed utilities, etc.

f. Details of foundation, leveling pad, aesthetics, or other detailed wall requirements.

g. Details of wall appurtenances such as traffic barriers, moment slabs, coping, fencing, drainage, or other obstructions including but not limited to the location and configurations of signs and lighting including conduit locations and right-of-way limits.

SANITARY SEWER

Trunk and Lateral Pipes

MaterialPVC

Class (0-13' bury)SDR 35

Class (13-25' bury)SDR 26

Class (25'+ bury) C900/DIP

Alignment Center of Street

Tracer WireGreen 12 Gauge Copper Clad Steel

Follow Minnesota Rural Water Association Tracer Wire Specification located at
<https://www.mrwa.com>

Minimum Trunk and Lateral Pipe Slope

The pipe diameter and slope shall be selected to obtain the greatest practical velocities to minimize settling problems. It is not acceptable to oversize pipe diameter for the purposes of reducing the pipe slope.

Minimum Pipe Slope Based on Pipe Diameter

<u>Pipe Diameter</u>	<u>Minimum Slope</u>	<u>Pipe Diameter</u>	<u>Minimum Slope</u>
8 inch	0.40 percent	15 inch	0.15 percent
10 inch	0.28 percent	16 inch	0.14 percent
12 inch	0.22 percent	18 inch	0.12 percent
14 inch	0.17 percent		

Testing

Air Test Method

The sewer section under test will be accepted as having passed the air leakage test when there is no measurable air loss, as measured by pressure drop, during the specified amount of time indicated in the table below. The starting air pressure shall be at least 4.0 psig. At least four (4) minutes shall be allowed for the air temperature to stabilize before readings are taken and the timing started.

Minimum Specified Time Required for a 0.0 psig Pressure Drop for Size and Length of Pipe

Pipe Diameter (inches)	Specification Time for Length Shown (Min:Sec)							
	100 Ft.	150 Ft.	200 Ft.	250 Ft.	300 Ft.	350 Ft.	400 Ft.	450 Ft.
4	4:00	4:00	4:00	4:00	4:00	4:00	4:00	4:00
6	4:00	4:00	4:00	4:00	4:00	4:00	4:00	4:00
8	4:00	4:00	4:00	4:00	4:00	4:26	5:04	5:42
10	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	13:05	17:27	21:49	28:11	30:32	34:54	39:16
24	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17

*NOTE – Consult with pipe and appurtenance manufacturer for maximum test pressure for pipe size greater than twenty-four inches (24") in diameter.

Deflection Test

The test shall be conducted after the sewer trench has been backfilled to the desired finished grade and has been in place for thirty (30) days or more.

The deflection test shall be performed by pulling a rigid ball or nine-point mandrel (MnDOT Technical Memorandum 98-24-B-01 or latest revision) through the pipe without the aid of mechanical pulling devices. The ball or mandrel shall have a minimum diameter equal to ninety five percent (95%) of the actual inside diameter of the pipe. The maximum allowable deflection shall not exceed five percent (5%) of the pipe's internal diameter. The line will be considered acceptable if the mandrel can progress through the line without binding.

Tracer Wire

The contractor shall perform a tracer wire test on all tracer wire lines along watermain. A city representative must be present for the duration of the test which shall be performed using a low frequency (512Hz) utility line locator.

Manholes

Type Precast Sections

Joints shall be constructed with confined O-Ring Gaskets - See City of Ramsey Standard Detail No. SEW-1.

Invert 0.10' above outlet

Sloped and grouted to provide smooth flow from inlet to outlet.

Rubber waterproof gasket required for pipe inserts.

Base (less than 14' deep) 5" precast or 6" poured

Base (greater than 14' deep) Increase thickness 2" per 6' of depth

Inside Drop 2' separation from invert to outlet

Reliner / Duran Style or approved equal.

8" base for manholes less than 14' deep, increase thickness 2" per 6' of depth beyond 14'.

Ductile Iron Pipe from tee to undisturbed soil.

Casting Rings Minimum 2, maximum 7 – 2" rings

All interior joints shall be grouted to a smooth finish. Wrap outside of rings with water tight product.

Casting 1733 Series Watertight Casting

See City of Ramsey Standard Detail No. SEW-2.

Tracer Wire Green 12 Gauge Copper Clad Steel

Follow Minnesota Rural Water Association Tracer Wire Specification located at <https://www.mrwa.com>

Services

Material PVC

Class SDR 26

Size Minimum 4" diameter

WYEs 10 or 2 O'clock position

Bends Maximum 22.5°

City Engineer approval required for bends greater than 22.5°.

Slopes Minimum 2% (Residential)

Riser Maximum 2:1 slope

Location End at ROW

Marker Minimum 2' above ground at ROW

Install 5' steel post painted green.

Tracer Wire 12 Gauge Copper Clad Steel

Follow Minnesota Rural Water Association Tracer Wire Specification located at
<https://www.mrwa.com>

Cleanout Minimum 100' interval along the service

Interval distance includes the riser.

WATERMAIN

Trunk and Lateral Pipes

Material	Ductile Iron Pipe or PVC or HDPE
Ductile Class (6" diameter or less)	53
Ductile Class (8" diameter or greater)	52
PVC Class	C900
HDPE	SDR11
Alignment	North and East side of street
Connection to Existing.....	Pipe Sleeves not acceptable
Connection to existing watermain must be made at valve, bend, or full section pipe.	
Size.....	8" minimum residential, 12" minimum commercial and industrial
Minimum Cover.....	7.5'
Insulation.....	Cover less than 7.5'
Insulation shall be used when the vertical clearance from the storm sewer is less than 2 feet.	
Material used shall be polystyrene or approved equal, two (2) 4' x 8' x 2" thick sheets with joints overlapping 4'.	
Joint Connection	Push on joint
Copper jumper required sized to carry 600 amps.	
All rubber gasket joints shall be in accordance with A.W.W.A. Specification C111.	
Restraints.....	Retainer Glands
American, US Pipe or Mega-Lug type, ductile iron, designed to withstand the design pressures indicated in the plans, specifications and special provisions.	
All nuts, bolts and tie rod type restraints shall be stainless steel or coated with an approved rustproofing material.	
Tracer Wire	Blue 12 Gauge Copper Clad Steel
Follow Minnesota Rural Water Association Tracer Wire Specification located at https://www.mrwa.com	

Testing

Hydrostatic Pressure

After the pipe has been laid and backfilled, including fittings and valves and blocking, all newly laid pipe or any section between valves thereof, unless directed otherwise by the Engineers, shall be subject to hydrostatic pressure of one hundred fifty (150) pounds per square inch (200 psi for fire suppression lines). The duration of each such test shall be at least two (2) hours.

The pressure gauge shall be a standard pressure gauge. The dial shall register from 0 – 200 psi and have a dial size of 4 ½” with one (1) psi increments. Pressure requirement for an acceptable test shall be a maximum pressure drop of two (2) psi during the two (2) hour pressure test. If this test requirement cannot be met, the Contractor shall investigate the cause, make corrections, and retest until the pressure drop requirement can be met.

Electrical Conductivity

The Contractor shall perform a conductivity test within one week after completion of pressure testing of the main on all ductile iron watermain to ensure continuous conductivity for the purpose of tracing watermain for utility location. Sufficient conductivity shall be provided to allow for the location of watermain, services, hydrant leads, and laterals for mainline segments at least one thousand two hundred (1,200) lineal feet in length.

Tracer Wire

The contractor shall perform a tracer wire test on all tracer wire lines along watermain. A city representative must be present for the duration of the test which shall be performed using a low frequency (512Hz) utility line locator.

Disinfection of Watermain

Before being placed in service, the completed watermain shall be disinfected. Disinfection materials and procedures, and the collection and testing of water samples, shall be in accordance with the provision of AWWA C-651. After final flushing of watermain, the water shall be tested for bacteriologic quality and found to meet the standards prescribed by the Minnesota Department of Health. The Contractor shall furnish all materials and perform the disinfecting, flushing, and testing as necessary for meeting the water quality requirements.

Valves

ValvesResilient Seated Waterous 2500 Series or approved equal

Valve Boxes 3-piece adjustable screw type boxes 60” – 90” extension

5 ¼” shaft size required. The word “water” shall be imprinted on each lid.

Valve nut extensions are not permitted.

One (1) valve wrench shall be supplied to the Public Works Department for each five (5) valves required on the Project.

Spacing..... Required at every intersection

Maximum spacing 500’ for single-family residential and 300’ for all other developments.

The City prefers a maximum of 11 lots to be served between valves.

Tracer Wire Blue 12 Gauge Copper Clad Steel

Follow Minnesota Rural Water Association Tracer Wire Specification located at <https://www.mrwa.com>

Fittings

MaterialMechanical Joint Ductile Iron – Mega Lugs or approved equal

The City does not allow 90° bends, except for hydrant leads.

Refer to US Pipe Catalog for weight of individual fittings.

Hydrants

Material5-1/4” WB67 Waterous Pacer or approved equal

One (1) hydrant wrench, one (1) break off section, and six (6) markers shall be supplied to the Public Works Department for each six (6) hydrants required on the Project.

Depth.....8’-0” bury

Barrel Section..... 16”

Spacing.....Maximum 300’ radius

Marker Striped red/white 4’ flex stake

Tracer Wire BoxCopperhead Cobra or approved equal

Top nut height..... 2.5’ above adjacent grade

Location Intersections, and on property lines

Hydrants shall be located at the high and low points on 12" + size watermain.

Hydrants shall be located within 150' of the Fire Department connection on nonresidential sites.

Plugged wherever groundwater table is above drain outlet

The 5" cap shall be painted yellow on all plugged hydrants.

Services

Material 1" Type K Copper

Corporation Stops

Material Mueller H-15000, Ford F600 or approved equal

Support Concrete Base Required

Minimum dimensions 4" width x 6" length x 2" thickness.

Curb Stops

Material Mueller 15154, Ford Z22 or approved equal

Boxes 12" adjustment to eight feet (8') when fully extended

Curb Box

Material Ford EM2-80-56 or approved equal

66" standard stationary rod or approved equal.

Thrust Blocks

All plugs, caps, tees, bends, and other thrust points shall be provided with reaction backing, or movement shall be prevented by attachment of suitable restraining devices or tie rods.

All horizontal bends exceeding twenty (20) degrees deflection, and all caps, plugs, and branch tees shall be provided with concrete buttress blocking.

All vertical bends exceeding twenty (20) degrees deflection shall be provided with concrete buttress blocking at the low points and with metal tie rod or strapping restraints at the high points.

Offset bends made with standard offset fittings need not be strapped or buttressed.

Hardwood blocking shall not be used.

Concrete buttresses shall be poured against firm, undisturbed ground and shall be formed in such a way that the joints will be kept free of concrete and remain accessible for repairs. The concrete mix used in buttress construction shall meet the requirements for Grade B concrete in conformance with MnDOT Specification Section 2461. Buttress dimensions shall be a minimum of twelve inches (12") in thickness, and the minimum area, in square feet shall be as follows.

Thrust Block Sizing

PIPE SIZE	TEE OR PLUG	1/4 BEND	1/8 BEND	1/32 BEND 1/16 BEND
6"	2.9	3.1	1.6	0.8
8"	3.7	5.3	2.9	1.4
10"	5.7	8.1	4.4	2.2
12"	8.1	13.4	6.6	3.2
16"	15.1	21.4	11.6	5.9
20"	23.2	30.2	18.1	9.3
24"	33.6	48.5	26.1	13.3

Contractors are instructed to size concrete buttress blocking on fittings and dead ends where the blocking must withstand the pressure of larger main line fittings equipped with reducers, for the larger sized main line thrust and not for smaller fitting size only. This is of particular importance on tees and crosses where the main size is reduced on the run from large to small size by use of reducers.

All metal parts of tie rod or strap type restraints shall be stainless steel or coated with other approved asphaltic type rustproofing.

STORM SEWER

Pipe

Material RCP

HDPE may be used in greenspace with City Engineer approval.

PVC may be used per MN Department of Labor and Industry (DLI) spec and with City Engineer Approval.

Change in pipe material, grade, or direction must occur in a manhole.

Tracer Wire Green 12 Gauge Copper Clad Steel

Tracer wire shall be installed with all storm sewer lines. Conductivity is required on all tracer wire.

Side of Street South and West

Class MnDOT Drainage Manual Chapter 2

Diameter of catch basin leads Minimum 12"

Diameter of laterals and trunk line Minimum 15"

Culvert Material RCP or CMP

Diameter Minimum 15"

Apron Required on all storm sewer system inlets and outlets

Trash guards are required on all aprons larger than 18" and / or when trash guards exist downstream.

Aprons greater than 36" diameter require storm sewer piling and concrete end section.
Tracer wire shall end at grade.

Catch Basins and Manholes

Material Precast Concrete Section

Use of concrete block requires City Engineer approval.

2'x3' catch basin Maximum 4' rim to sump height

Precast openings as required.

Tracer Wire Green 12 Gauge Copper Clad Steel

Tracer wire shall be installed with all storm sewer structures. Tracer wire shall end in the structure as close to finish grade as practical on manholes and catch basins. Tracer wire shall have enough length to wrap around the top step inside the structure and end at the grate on flared end sections.

Build.....	4' minimum to prevent freezing
Steps.....	Required for structures 4' deep or greater
Casting (Storm Manhole).....	Watertight Casting R-1733 Series or approved equal
Casting (Non-Traffic Areas).....	R-2570 or approved equal
Casting (Non-Traffic Areas).....	R-2560 Series or approved equal
Beehive Grates with frame suitable for drainage circumstances where clogging of a flat grate is probable.	
Casting (Surmountable Curb)	R-3501T or approved equal
Casting (Surmountable adjacent to radius).....	R-3246R or approved equal
Casting (B Type Curb).....	R-3246R or approved equal
Casting Rings	Minimum 2, maximum 7 – 2" rings
All interior joints shall be grouted to a smooth finish. Wrap outside of rings with water tight product.	

Ponding

Maximum Slope.....	4:1 Above NWL, 3:1 Below NWL
10' Maintenance bench required at NWL.....	10:1
Provide maintenance access route(s).	
Must meet Lower Rum River Watershed Management Organization (LRRWMO) standards. Information available at www.lrrwmo.org .	

Rip Rap

Class.....	Class III (Jagged)
Rip rap to be placed on all pipe outlets in 18" thick layer.	
Geotextile fabric shall cover the bottom and sides of the area excavated for the rip rap material.	
See City of Ramsey Standard Detail No. ERO-3.	

Design

Frequency.....	10-Year design for lateral sewer
Catch basin spacing follow MnDOT maximum allowable spread table with the 10 year design frequency.	
Detention basin	Atlas 14 – 100 year event

Detention basin (land locked)Back to back Atlas 14 – 100 year event

Frequency..... within the COR

All trunk storm sewer within the COR must be sized to convey the 100 year storm runoff from all new development.

Velocity (self-cleaning)Minimum 3.0 fps

Infiltration basin.....First 1” of runoff from new impervious surfaces

No infiltration is allowed within any municipal water supply well 10 year capture zone. Must contribute to the infiltration mitigation fund in such instances. Contact City Engineering Department for more information.

Water quality treatment providing annual removal efficiency of 60% total phosphorus and 90% total suspended solids.

Pond outlets..... Skimmer manhole

Rate control..... Atlas 14 – 2 year, 10 year, and 100 year storm events

Lowest floor elevation – highest of:

Minimum 3 feet above highest anticipated groundwater table, 2 feet above the designated or designed 100-year flood elevation, or 1 foot above the emergency overflow

Testing

Tracer Wire

The contractor shall perform a tracer wire test on all tracer wire lines along watermain. A city representative must be present for the duration of the test which shall be performed using a low frequency (512Hz) utility line locator.

Methodologies

Infiltration basin sizing1” rainfall event

Follow MPCA MIDS Calculator, latest version.

Water quality pond sizing Walker Spreadsheet

Water quality efficiency goal attainment.....MIDS Calculator

Rate control modeling..... Hydro CAD or other approved dynamic routing software

Storm sewer sizing..... Rational method spreadsheet

Stormwater report

Narrative describing site and treatment methods, tabular comparison of existing and proposed conditions and rate reductions provided for 2-year, 10-year, and 100-year storms. Hydro CAD printouts for the 1”, 2-year, 10-year, and 100-year storms. The project name and engineer name must be on the page header of the report.

Manning’s Roughness (n) for Pipes

<i>Conduit Material</i>		<i>Manning n</i>
Cast Iron Pipe	Coated	0.010 – 0.014
	Uncoated	0.011 – 0.016
Concrete	Culvert, straight and free of debris	0.010 – 0.013
	Sewer with manholes, inlet, etc., straight	0.013 – 0.017
	Finished	0.011 – 0.014
	Unfinished, steel form	0.012 – 0.014
	Unfinished, rough wood form	0.015 – 0.020
Corrugated Metal	Sub drain	0.017 – 0.021
	Storm drain	0.021 – 0.030
HDPE Pipe		0.011 – 0.015
Vegetated Channel		0.030 – 0.060

Source: Autodesk Hydra flow Storm Sewers Extension

Runoff Coefficients for Rational Formula

TYPE OF DRAINAGE AREA			RUNOFF COEFFICIENT
Business	Downtown areas		0.70 – 0.95
	Neighborhood areas		0.50 – 0.70
Residential	Single-family areas		0.30 – 0.50
	Multi-units	Detached	0.40 – 0.60
		Attached	0.60 – 0.75

	Suburban		0.25 – 0.40
	Apartment dwelling areas		0.50 – 0.70
Industrial	Light areas		0.50 – 0.80
	Heavy areas		0.60 – 0.90
Parks, Cemeteries			0.10 – 0.25
Playground			0.20 – 0.35
Railroad yard areas			0.20 – 0.40
Unimproved Urban areas			0.10 – 0.30
Lawns	Sandy Soil	Flat, 2%	0.05 – 0.10
		Average, 2 – 7%	0.10 – 0.15
		Steep, 7%	0.15 – 0.20
	Heavy Soil	Flat, 2%	0.13 – 0.17
		Average, 2 – 7%	0.18 – 0.22
		Steep, 7%	0.25 – 0.35
Streets	Asphaltic		0.70 – 0.95
	Concrete		0.80 – 0.95
	Brick		0.70 – 0.85
Drives and Walks			0.75 – 0.85
Roofs			0.75 – 0.95
Rural	Average infiltration rates sandy & gravel soils	Cultivated	0.20
		Pasture	0.15
		Woodlands	0.10
	Average infiltration rates; Loams and similar soils with no clay pans	Cultivated	0.40
		Pasture	0.35
		Woodlands	0.30
	Below average infiltration rates; heavy clay soils; soils with a clay pans near the surface; shallow soil above impervious rock	Cultivated	0.50
		Pasture	0.45
		Woodlands	0.40

Source: MnDOT Drainage Manual