

PART 9 - STORM SEWERS AND STORM WATER MANAGEMENT FACILITIES

Part 9 Revised 5/31/06

9.01 APPROVALS, PERMITS, AS-BUILTS, AND MAINTENANCE BONDS

- A. Plans and specifications for public storm sewer and storm water management facilities must be certified by a professional engineer registered in the State of Iowa and utilizes the NGVD of 1929.
- B. Plans and specifications for public facilities must be reviewed and approved by the City Engineer prior to construction.
- C. Other local, state and federal permits may be required, depending on the circumstances. It shall be the responsibility of the Engineer of Record to acquire all applicable permits. A copy of all permits shall be provided to the City Engineer before construction.
- D. The Engineer of Record is responsible to submit "Record of Construction" drawings to the City Engineer on reproducible velum or Mylar, and a digital base map in an AutoCAD file or other approved electronic format. Drawings shall include the horizontal locations of services.
- E. A 4-year maintenance bond covering defective materials and workmanship is required for all storm sewer and storm water management facilities.

9.02 PERMITTED FLOWS

- A. No sanitary sewers, sanitary sewer services or septic tanks shall be discharged into storm sewers.
- B. No flows from commercial car washes shall be discharged into storm sewers.
- C. Sump pump discharge of ground and surface water is permitted only after review and approval by City Engineer.
- D. Only ground water is permitted in tile lines less than 12 inches in diameter. No roof drains or sump pumps are permitted in these systems.

9.03 DESIGN FLOWS AND CAPACITY

- A. Storm sewer systems consist of pipe and overland flow routes to convey storm water. All storm sewer designs shall contain both components.
- B. Storm sewer pipes shall be designed to convey the 5-year return frequency flow except for pipe used to discharge water from storm water management facilities (see Section 9.13).

If the 5-year return frequency flow exceeds the capacity of a 48-inch pipe, open channel flow may be used in lieu of an enclosed system upon approval of the City Engineer. Generally, this will be approved only where a stream or creek exists.

- C. The overland flow route shall be designed to convey the 100-year return frequency flow assuming the pipe is inoperative. Such routes shall be designed to convey the flows without damage to property and shall be clearly designated on the construction drawings and final plat or site plan.
- D. All design flows shall be calculated using commonly accepted engineering practices appropriate for the size of the drainage area under consideration. All designs shall consider existing and fully developed conditions and use the larger of the 2 flows.
- E. The minimum size for any storm sewer receiving surface water is 15 inches in diameter, excluding storm water management control structures. The minimum size for subsurface drainage pipes receiving only ground water and storm water management control structures is 6 inches in diameter.
- F. All storm sewer pipes shall have a slope which will give a mean velocity when flowing full of not less than 2.0 feet per second based on Manning's formula using a minimum "n" value of 0.013.
- G. Where velocities in a pipe are calculated at greater than 10 feet per second, special provisions shall be made to protect against displacement, abrasion or shock.
- H. All area intakes (excluding street intakes) shall include trash racks and be designed assuming 25% blockage by debris.
- I. The maximum slope for storm sewer outlet lines shall be 10%.

If RCP is utilized for outlet lines having a slope greater than or equal to 8%, all joints must be tied together.

The flared-end section and last 2 pipe joints shall be tied together in all instances.

9.04 OPEN CHANNEL FLOW

- A. The erosion potential of the soil shall be evaluated with regard to anticipated velocities. Appropriate measures shall be taken to protect the soil and/or reduce velocities to prevent erosion.
- B. The channel capacity in conjunction with possible over-bank flow shall be designed to safely convey the 100-year return frequency flow. If over-bank flow is considered, its impact must be evaluated and area of conveyance protected by easement.

9.05 SUBSURFACE DRAINAGE

- A. In predominantly wet areas, areas containing hydric soils and other such areas designated by the City Engineer, a subsurface drainage system shall be provided to receive the discharge from sump pumps.
- B. A 2-inch service connection manufactured specifically for the pipe being used and approved by the City Engineer shall be provided for each lot abutting the subsurface drainage system.
- C. The end of all sump pump services shall be marked with a metal post or #4 reinforcing steel at least 24 inches in length buried to within 1 foot of the finished grade.

9.06 INTAKES AND DRAINAGE OF STREETS

- A. All intakes on public streets will be designed to the IDOT Type RA standards.
- B. DOT RA-16 intakes are allowed on storm sewer laterals.
- C. Intakes shall be spaced so that for a 5-year storm arterial streets shall have 2 traffic lanes free of excess water at all times. Local and collector streets shall be designed to have one 12-foot traffic lane free of water. Storm water shall not cross an intersection, but can follow a curb around its radius.
- D. For a 100-year storm, the ponding of surface water on local, collector, and arterial streets must not exceed a depth of 1 foot at the gutter. Water exceeding 1 foot shall be designed to overflow into an overland flow route. This applies to temporary ponding from local drainage only.
- E. Streets in flood plains designated on the FEMA Flood Insurance Maps shall be elevated at their lowest point to the 100-year flood elevation.
- F. Minimum drop through intake structures shall be the same as required for manholes (see 9.08.B).

9.07 PIPE STANDARDS AND STRENGTH DESIGN

A. **Reinforced concrete pipe** meeting the following standards may be used for pipe 15 inches in diameter or larger.

1. Joints:
 - a. Circular pipe: All joints will be a confined O-ring gasket meeting ASTM C443. All pipe 36-inch diameter and smaller will have bell and spigot joints. Pipe larger than 36-inch diameter may have tongue and groove joints. If the hydraulic grade line is less than 6 inches above the top of the pipe during the 100-year event, O-ring gaskets may be omitted, provided each joint is wrapped with 24 inches of approved filter fabric.
 - b. Low head pipe: All joints shall be wrapped with 24 inches of approved filter fabric.
2. Wall Thickness: Minimum wall thickness will be B-wall as defined in ASTM C-76.
3. The required pipe strength and bedding requirements shall be calculated on a case-by-case basis. The minimum pipe strength shall be Class III as defined in ASTM C-76.
4. Pipe Markings: All pipe shall be marked with the date of manufacture and ASTM class. If quadrant reinforcement is used, the top shall be marked on the outside of the pipe.
5. No lift holes.
6. All RCP shall be manufactured by an IDOT certified facility.

B. **Ductile iron pipe** meeting the following standards may be used.

1. Joints: Use push on gasketed joints.
2. Thickness: Use Pressure Class 350 standard unless a thicker wall is required because of depth.
3. Lining and Coating:
 - a. Inside of pipe and fittings: Double thickness cement lining and bituminous seal coat conforming to ANSI/AWWA-C104/A21.4-95.
 - b. Outside of other pipe and fittings: Standard bituminous coating conforming to appropriate ANSI Standard.

C. **Subsurface Drainage Pipes** meeting the following specifications may be used for

subsurface drainage systems:

1. Corrugated PVC with a smooth interior wall meeting the standards of ASTM F949-90 constructed of resins meeting the requirements of ASTM D1784, cell class 12454B may be used for 6-inch, 8-inch and 10-inch diameters.
 2. Corrugated HDPE with a smooth interior wall from a manufacturer approved by the City Engineer may be used for 6-inch diameter.
 3. All subsurface drainage pipes shall be perforated and shall be protected by a fabric sock or freely draining aggregate placed around the pipe. Subsurface drainage pipes serving as pavement subdrains shall be surrounded by a freely draining aggregate that extends up to and contiguous with the aggregate base of the pavement.
- D. The designer shall specify pipe material, bedding and trench width to withstand anticipated dead and live loads. Minimum pipe bedding shall be Type B.
- E. See pipe bedding diagrams, Figure 8.4

9.08 MANHOLE AND INTAKE STANDARDS

- A. Manholes or intakes shall be located as follows:
1. At the end of each line.
 2. At all changes in grade, size, or alignment.
 3. At all intersections of pipes.
 4. At distances not greater than 400 feet for sewers 15 inches or less in diameter and 600 feet for sewers 18 inches to 30 inches in diameter. Greater spacing may be permitted in larger sewers.
 5. Flared end sections are required at all storm sewer line outlets.
- B. Minimum Drop Access Manholes
1. For the same size pipe with a change in alignment of 45° or less, no drop is required.
 2. For the same size pipe with a change in alignment of greater than 45°, or junction of 2 pipes, a 0.2-foot drop is required.

3. For the same size pipe with a junction of 3 or more pipes, a 0.3-foot drop is required.
 4. When a smaller sewer joins a larger one, the invert of the larger sewer shall be lowered sufficiently to match the 0.8 depth point of both sewers at the same elevation.
- C. Bedding: All precast manhole bases shall be placed on a minimum of 6 inches of crushed stone bedding.
- D. Materials
1. Joints: All joints will be confined O-ring gasket meeting ASTM C443.
 2. No lift holes through the entire wall.
 3. Mark class and date of manufacture.
 4. Inverts: Precast and cast-in-place inverts must provide a channel at least $\frac{1}{2}$ the depth of the pipe and match the full cross-sectional area of the pipe. All junctions and changes in directions of inverts shall be smooth and rounded to the maximum extent possible to supplement flow through the manholes.
 5. Diameter: The minimum diameter for manholes is 48 inches for pipe 24 inches in diameter and smaller, and 60 inches for pipe greater than 24 inches in diameter. Manholes 72 inches in diameter may be required for pipes greater than 36 inches in diameter. Reducers may be used above the chamber section of 60-inch and 72-inch manholes. Precast tees may be used on pipes 48 inches and larger in diameter.
 6. Castings shall be Neenah R-1642 and Type "B" non-rocking self-sealing lid or approved equal.
 7. Intake casting shall be Neenah R3067 with Type "DL" grate.
- E. Standard manholes, step details, and risers are the same as for sanitary sewers as shown in Figures 8.1, 8.2 and 8.3, except cretch chimney seals are not required.
- F. All manholes shall be marked with 2 metal fence posts to remain in place until landscaping is complete. In subdivisions, the posts shall remain in place until landscaping has been completed by the lot owner.
- G. Concrete spacer rings or metal shims shall be the only materials utilized to adjust manhole frame elevations. Mastic or grout must be used to bond and seal materials used for adjustment.

9.09 PROTECTION OF WATER SUPPLIES

- A. There shall be no physical connection between a public or private potable water supply system and a sewer appurtenance which would permit the passage of any sewage or polluted water in the potable supply.
- B. Under normal conditions, water mains parallel to sewers shall be placed at least 10 feet horizontally from any sanitary sewer, storm sewer or manhole. Where local conditions prevent this separation, the water main may be laid closer provided the bottom of the water main is at least 18 inches above the top of the sewer and the water main is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the sewer.
- C. Water mains crossing sewer services, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. Where local conditions prevent this vertical separation, the water main shall not be placed closer than 6 inches above a sewer or 18 inches below a sewer under any circumstances. Additionally, 1 full length of water pipe crossing the sewer shall be centered at the point of crossing so that the water pipe joints will be equal distance as far as possible from the sewer. The water and sewer pipes must be adequately supported and have pressure tight joints. A low permeability soil shall be used for backfill material within 10 feet of the point of crossing.
- D. No water pipe shall pass through or come in contact with any part of a sewer manhole. A minimum horizontal separation of 3 feet shall be maintained.

9.10 MINIMUM COVER, BACKFILL AND BEDDING

- A. The minimum cover for storm sewers shall be 1 foot below the bottom of pavements and 2 feet below the surface of non-paved areas. All shallow pipe shall be designed to withstand anticipated live loads.
- B. Within public right-of-way, backfill shall consist of crushed stone placed in 1 foot lifts and compacted to 90% modified proctor density or suitable job excavated material placed in 1-foot lifts and compacted to 90% Modified Proctor Density. If crushed stone is used, the top 12 inches of backfill shall consist of suitable job excavated materials. Flowable mortar may be used upon approval of mix design by the City Engineer. Sand backfill is not permitted.
- C. All other areas - backfill shall consist of suitable job excavated material placed in 1-foot lifts and compacted to 85% Modified Proctor Density.

9.11 PERFORMANCE & TESTING

- A. All sewers and manholes will be lamped and visually checked prior to acceptance.
- B. All tests will be completed after backfill is complete.
- C. All flexible pipe 12 inches in diameter and larger shall have a deflection test conducted after the final backfill has been in place for at least 30 days. No pipe shall exceed a deflection of 5%. The deflection test is to be run using a rigid ball or mandrel having a diameter equal to 95% of the inside diameter of the pipe and the tests shall be performed without mechanical pulling devices.

9.12 SEWER LOCATION AND EASEMENTS

- A. Manholes in street right-of-way must be located in areas which allow direct access by maintenance vehicles. Manholes in areas outside the street right-of-way shall be subject to the approval of the City Engineer, in which case access to the manhole shall be along a route in which the transverse slope does not exceed 4% and longitudinal slope does not exceed 12%.
- B. Sewers shall be placed a minimum horizontal distance of 1.5 times the depth from potential or existing building sites. Greater separations are desirable.
- C. All storm sewers outside public right-of-way shall be placed in an easement for operation and maintenance. Easement width from the center of the pipe shall generally be 1.5 times the sewer depth rounded up to the nearest 5 feet.
- D. The minimum easement width is 20 feet.
- E. Drainageway easements for overland flow shall be of sufficient width to contain the 100-year flow and as a minimum shall include the bottom width and side slopes of the drainageway and any necessary overbank areas.
- F. Storm sewer mains shall be extended to, through or across the frontage of all subdivisions and land development projects. Provisions will be made to connect storm sewer mains to serve future adjacent undeveloped land.

9.13 STORM WATER MANAGEMENT FACILITIES

- A. Thresholds:
 - 1. Storm water management will be required for all new subdivisions and resubdivisions of residential, commercial and industrial developments larger than 3 acres in size.

2. In developments where the natural drainage is divided into more than one watershed, the individual watershed drainage areas must meet the criteria mentioned in A.1 above before storm water management is required. However, the designer has to account for the storm water runoff, which may include easements from downgrade property owners, to ensure public safety and not create property damage.
3. No storm water management facilities are required if storm water runoff from a development, up to and including the 100-year storm, can be piped or conveyed in its entirety directly to the Cedar River without significant adverse impact to intervening properties.

Similar waivers of storm water management requirements may be considered on other watersheds on a case-by-case basis.

5. A storm water management fee may be assessed to developments excluded from the storm water management requirements by Section 9.13 (A), if established by Council.

B. Detention Requirements:

1. New developments which require storm water management shall be required to detain the difference in the volume between the 5-year undeveloped storm and the 100-year developed storm events for their development site. For redevelopment of a site that does not presently have storm water management, the undeveloped condition shall be calculated assuming pasture conditions.
2. The maximum release rate for detention calculations shall be the 5-year undeveloped storm.

C. Methodology:

1. The SCS TR-55 computerized runoff volume program or other technically-proven methods, shall be used to determine the volume of runoff which must be detained.
2. The results of these calculations shall be submitted on a standardized form which shall include all of the individual parameters that the designer inputs into the program.

D. Locational Criteria:

1. Regional storm water management facilities are encouraged.

2. Regional storm water management facilities which are of sufficient size may be deeded to and maintained by the City. The conditions for City ownership will be reviewed on a case-by-case basis.
3. Storm water detention is not allowed within any front or side yard setbacks required by building code, or within 25 feet from the estimated back building line.

E. Design Considerations:

1. Dry-bottomed detention facilities shall be oversized by 10% to help offset anticipated sedimentation prior to total watershed development.
2. Maximum side slopes of dry bottom facilities shall not exceed $3\frac{1}{2} : 1$.
3. Low flow pipes are required to convey low flows from storm sewer outlets to the detention facility outlet structure. Low flow pipes shall be a minimum of 15 inches in diameter unless it can be shown that the bottom of the detention facility will remain dry. Low flow pipes shall be slotted and bedded in freely draining aggregate. Alternate methods of subsurface drainage may be proposed.