

E. **Hydrants:** The following standards will be required for new developments and for hydrant replacements or upgrades.

Specification standard:	AWWA Standard C502
Acceptable manufacturers and model:	Waterous Trend Traffic, Mueller Centurion, or approved equal
Type of shutoff:	Compression
Type of construction:	Break flange or break bolt
Main valve opening:	5¼" minimum
Nozzle arrangement and size:	
3 nozzles	Two 2½-inch hose nozzles and one 4½-inch pumper nozzle. The 4½" pumper nozzle is to face the street, or at an intersection, face the higher classification street.
Nozzle thread:	National Standard Hose Threads
Type of inlet connection:	Mechanical Joint
Size of inlet connection:	6 inch
Depth of bury:	Distance from ground line to top of connecting pipe shall be 5½ feet
Direction of opening:	Open to left (counter-clockwise)
Packing:	Conventional or O-Ring
Size and shape of operating nut:	1½ inch, standard pentagon
Working pressure:	150 psi
Color:	Yellow

F. **Special Fittings:**

1. Special pipe fittings must be approved by the City Engineer.

2. Special fittings must be the same diameter, thickness and pressure class as standard fittings.
3. Special fittings shall be manufactured to meet requirements of same specifications as standard fittings except for laying length and types of end connection.
4. Swivel fitting shall be Tyler 5-198 or approved equal. Retaining spools may be used.
5. Cast iron tapping sleeves shall be Mueller or Clow.
6. Stainless steel tapping sleeves shall be epoxy coated with ductile-iron flange and shall be compatible with Mueller or Clow tapping valves. Sleeves shall be Ford FAST, Smith-Blair 662 and 663 or Romac SST.
7. Tapping sleeves for 12 inch or 16 inch shall be ductile iron or CASI. The outlet of the tap shall not be greater than $\frac{1}{2}$ of the diameter of the pipe tapped.

G. Sleeve Type Couplings:

1. Standard solid black sleeves shall be Tyler 5-144L or approved equal. Bolted straight coupling shall be Smith-Blair 441 or Romac Style 501, 6 bolt, 6" long, or approved equal.

H. Gaskets, Bolts, and Nuts:

1. Mechanical joints made with:
 - a. Bolts: $\frac{3}{4}$ inch Cor-ten steel.
 - b. Bolt studs with nut on each end.
2. All thread rod used to restrain fittings shall be stainless steel and $\frac{3}{4}$ " diameter.

6.07 BEDDING AND BACKFILL:

- A. All D.I.P. mains 12 inch and larger shall be bedded in crushed stone to a depth of one-half the pipe diameter.
- B. All other pipe shall be bedded in accordance with manufacturer's recommendations.
- C. Within public right-of-way, backfill shall consist of suitable job excavated material placed in one foot lifts compacted to 90% Modified Proctor Density. If crushed stone is used, fill to top 12 inches with granular backfill or approved suitable job excavated

materials. Flowable mortar may be used upon approval of mix design by the City. Sand backfill is not permitted.

- D. In all other areas backfill shall consist of suitable job excavated material placed in one foot lifts and compacted to 85% Modified Proctor Density.

6.08 PERFORMANCE AND TESTING:

- A. Testing shall be performed under the supervision of the City's designated representative, or as otherwise directed by the City Engineer.
- B. Bacterial test for coliform organisms shall be performed by the contractor in accordance with AWWA C601. A minimum free residual chlorine concentration of 10mg/l shall be maintained for the 24-hour disinfection period. The contractor shall provide documentation of bacterial tests from a certified laboratory.
- C. Pressure and leakage test in accordance with AWWA C600.
- D. Valves shall be located and tested to verify operation.
- E. Fire hydrants shall be tested to verify operation.
- F. Flow tests shall be conducted to verify that all components of the water system are fully open and operational and to determine fire flow capacity.

6.09 LOCATION OF EASEMENTS:

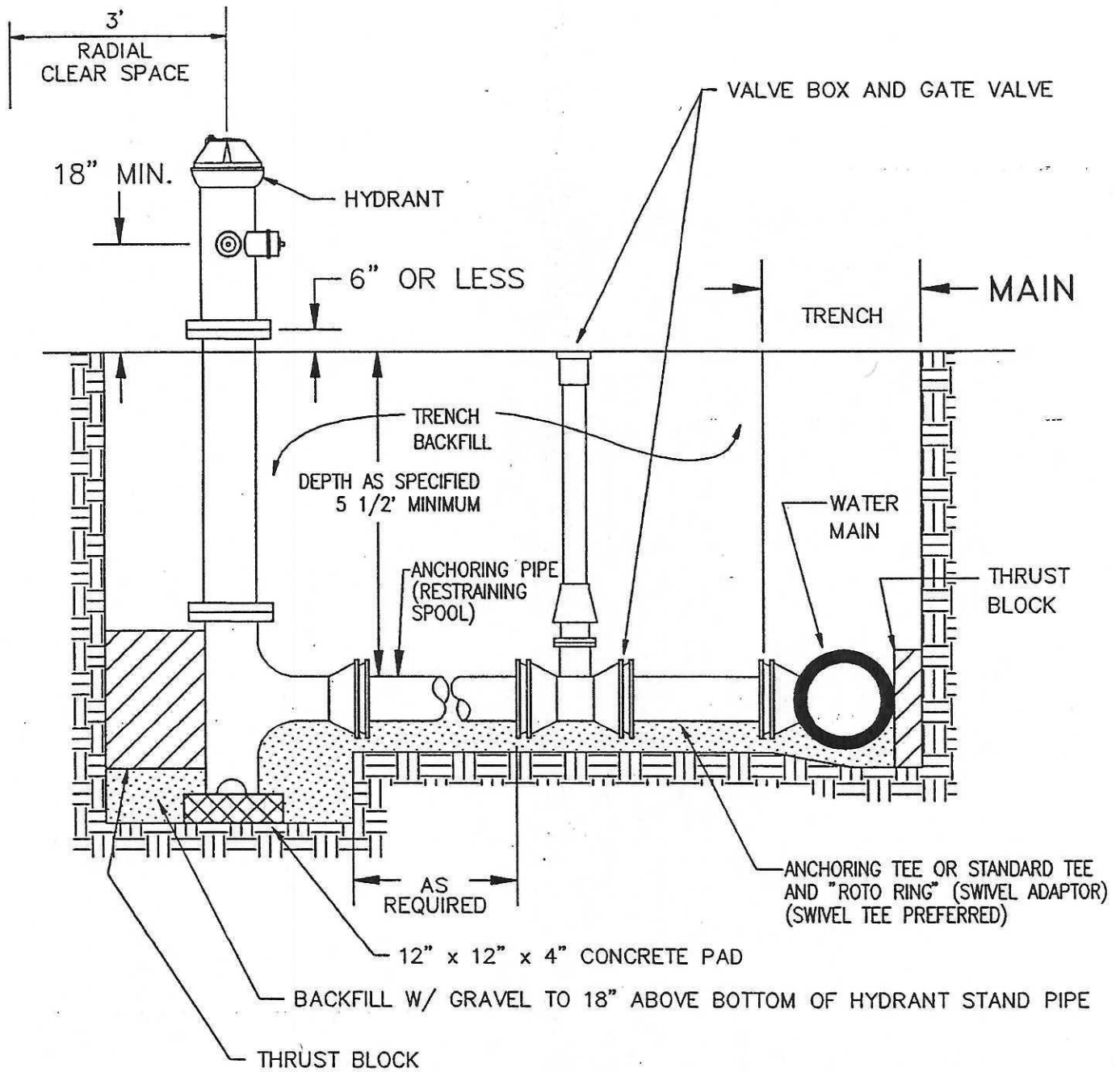
- A. All public water mains should be located within the public right-of-way. In rare exceptions, dedicated easements may be used for location of water main outside of public right-of-way.
- B. To limit damage to structures in the event of a main break, water mains shall be placed a minimum distance of 1.5 times the depth from building setback lines. Greater separations are desirable.
- C. All water mains 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 1.0 times the pipe depth rounded up to the nearest 5 feet.
- D. The minimum easement width is 10 feet.

**TABLE 6.1
WATER SERVICE CONNECTIONS ⁽¹⁾**

Type	Number of Water Services	Number of meters And Billing Requirements
SINGLE FAMILY	1-1 inch	1 Meter. Individual Billing.
DUPLEX OR ZERO- LOT LINE	2-1 inch	1 Meter for Each Unit. Individual Billing.
TOWNHOUSE OR MULTIPLE SIDE- BY-SIDE APTS.	1-1 inch for each unit	All units must be plumbed for individual meters. Apartments or condominiums with specific by-laws may have single meter and billing.
MULTI-STORY APARTMENTS MAX. 6 UNITS	1-1½ inch, see below	All units must be plumbed for individual meters. Apartments or condominiums with specific by-laws may have single meter and billing.
MULTI-STORY APARTMENTS 7 UNITS OR MORE**	Requires City Engineer approval. Must be sized for available main pressures and line distances. May require larger private service built to City standards.	All units must be plumbed for individual meters. Apartments or condominiums with specific by-laws may have single meter and billing.
COMMERCIAL OR MIXED USE DEVELOPMENT	Requires City Engineer Approval. Must be sized for available main pressures and line distances. May require larger private service built to City standards.	All units must be plumbed for individual meters. Commercial and residential users must have separate meters and billing.

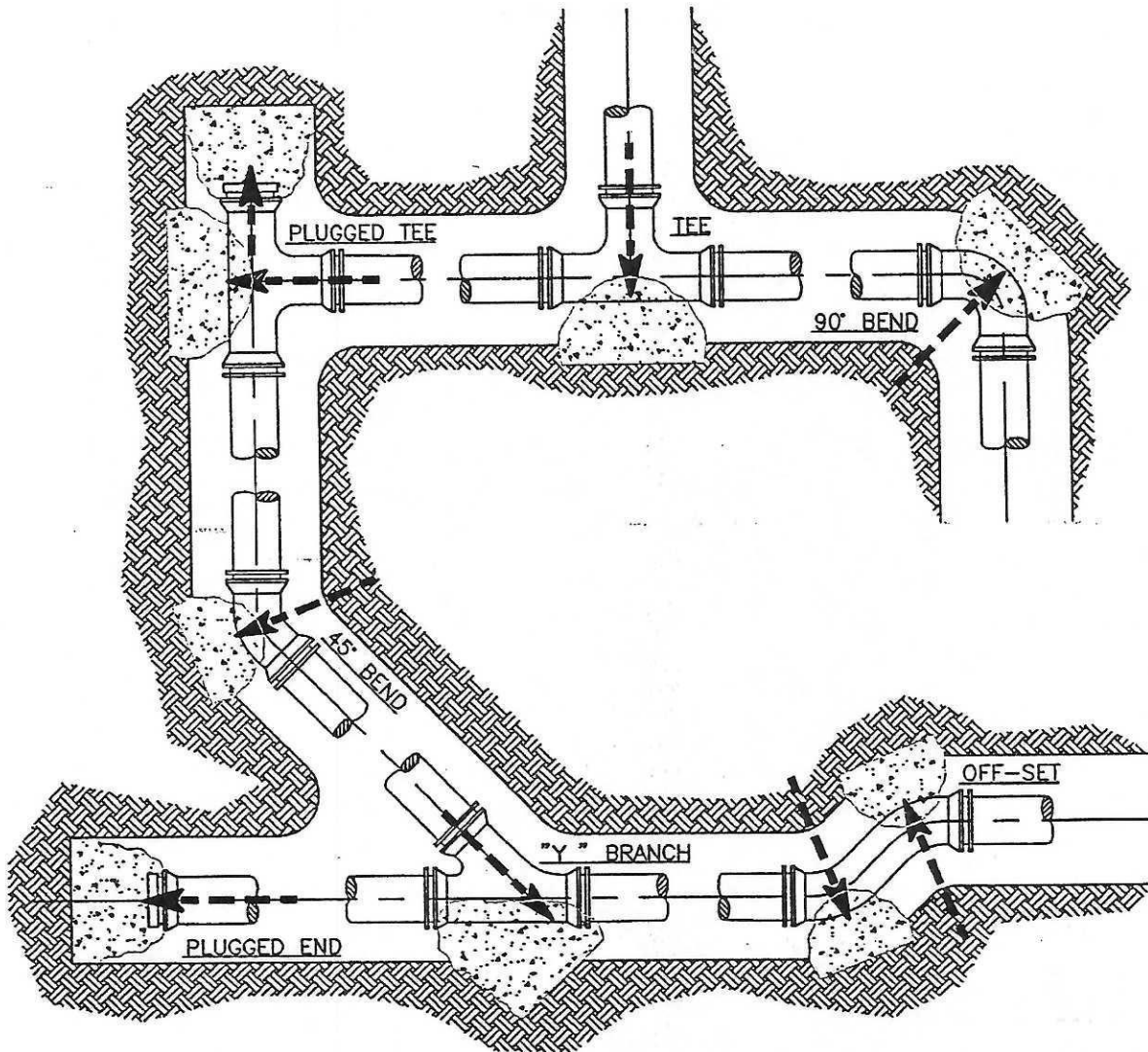
(1) All services shall be designed to accommodate available pressures in existing watermain, Distances from the main to the user, and the City's fire protection requirements.

** Apartment or condominiums with three habitable stories or any other structure with 9 or more dwelling units is required to provide a fire protection sprinkler system. This system must be designed in accordance with the City's Building Code requirements, and be approved by the City Engineer.



TYPICAL HYDRANT

FIGURE 6.1

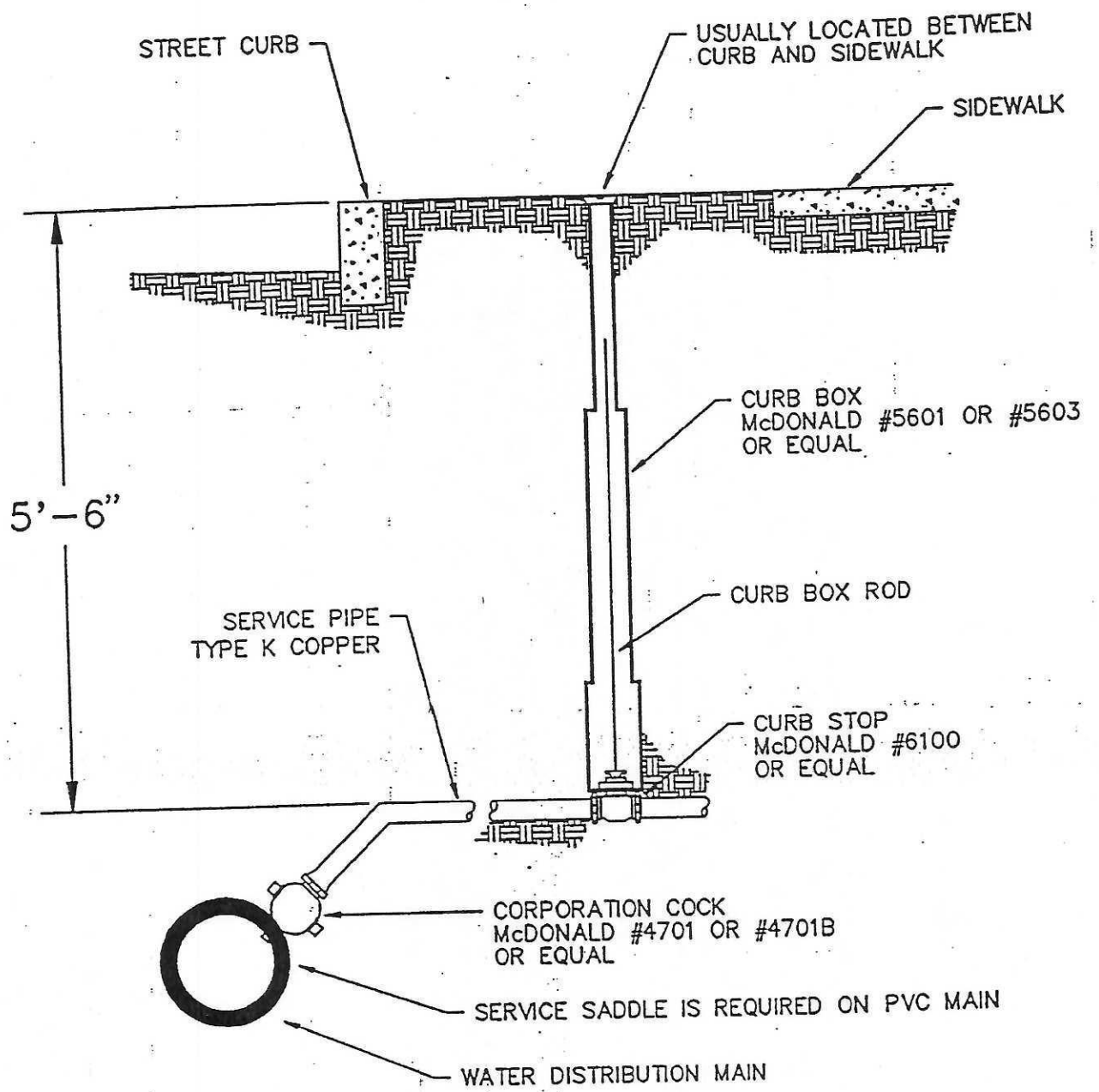


THRUST BLOCKS ARE REQUIRED AT PIPING DIRECTION CHANGES, AT DEAD ENDS, AND AT FIRE HYDRANTS. THRUST BLOCKS SHALL BE POURED-IN-PLACE CONCRETE 2000 P.S.I. MINIMUM STRENGTH, A MINIMUM OF 18 INCHES THICK, AND SHALL BE CAST AGAINST A SOLID, UNDISTURBED EDGE OF TRENCH FOR BEARING. NO BOLTS, JOINTS OR DRAIN HOLES SHALL COME INTO CONTACT WITH THE CONCRETE THRUST BLOCK AND THE PIPE SHALL BE WRAPPED WITH A PLASTIC SHEET AT THE CONCRETE BEARING SURFACES.

PIPE SIZE	DEAD END OR TEE	90° BEND	45° BEND	11-1/4° OR 22-1/2° BEND
4"	3.0	4.0	2.0	1.5
6"	6.0	8.0	4.5	2.5
8"	10.0	14.0	7.5	4.0
10"	14.5	20.5	11.0	6.0
12"	20.5	29.0	16.0	8.0
14"	27.5	39.0	21.0	11.0
16"	35.5	50.5	27.5	14.0
20"	55.0	78.0	42.0	21.5
24"	78.5	111.0	60.0	30.5

THRUST BLOCK QUANTITIES (in cubic feet)

FIGURE 6.2



WATER SERVICE

FIGURE 6.3

PART 7 - SANITARY SEWERS

7.01 APPROVALS, PERMITS, AS-BUILTS, AND MAINTENANCE BONDS:

- A. Plans and specifications for public sanitary sewer facilities must be certified by a professional engineer registered in the State of Iowa and utilize the NGVD of 1929.
- B. Plans and specifications for public sanitary sewer facilities must be reviewed and approved by the City prior to construction.
- C. Plans and specifications for public sanitary sewer facilities must be reviewed and approved by the Iowa Department of Natural Resources prior to construction. 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 before construction.
- D. The Engineer of Record is responsible to submit "Record of Construction" drawings to the City on reproducible vellum, mylar, and on electronic CAD for City mapping, and shall include the horizontal locations of services.
- E. A two-year maintenance bond covering defective materials and workmanship is required for all sanitary sewer facilities.

7.02 DESIGN RESOURCES AND REFERENCES:

The design for sanitary facilities shall be in conformance with the following:

- A. Requirements and Standards of the Iowa Department of Natural Resources.

7.03 PERMITTED FLOWS AND CONNECTIONS:

- A. No combined sewers shall be constructed. Sanitary and storm sewers shall be kept separate.
- B. Only sewage shall be permitted in the sanitary sewers. Footing drains, downspouts, sump pumps, etc., conveying clear water will not be allowed to discharge into the sewer system. Air conditioning condensation water may be allowed in the sanitary sewer.

- C. Flows from commercial car washes must be discharged to the sanitary sewer after passing through approved oil and sediment traps.
- D. Each building shall have a direct connection to a public sewer.

7.04 DESIGN FLOWS AND CAPACITY:

A. The peak wet weather **Design Flows** for various land usage are as follows: ** adjust the peaking factor for communities less than 10,000:

1. Single Family Dwellings
 (100 gal/cap/day) x 2.5 (peak factor) +
 1200 gal/acre day (infiltration) = 250 gpcd + infiltration
 Assume 3.5 people/home
2. Mobile Homes
 (50 gal/cap/day) x 2.5 (peak factor) +
 1200 gal/acre day (infiltration) = 125 gpcd + infiltration
 Assume 2.5 people/home
3. Multi Family Dwellings
 (75 gal/cap/day) x 2.5 (peak factor) +
 1200 gal/acre day (infiltration) = 187 gpcd + infiltration
 Assume 1.5 people/bedroom
4. Motels and Hotels
 (50 gal/cap/day) x 2.5 (peak factor) +
 1200 gal/acre day (infiltration) = 125 gpcd + infiltration
 Assume 1.5 people/room
5. Schools, without cafeteria or showers
 (10 gal/cap/day) x 2.5 (peak factor) +
 1200 gal/acre day (infiltration) = 25 gpcd + infiltration
6. Schools, with cafeteria or showers
 (20 gal/cap/day) x 2.5 (peak factor) +
 1200 gal/acre day (infiltration) = 50 gpcd + infiltration
7. Office Buildings
 (10 gal/cap/day) x 2.5 (peak factor) +
 1200 gal/acre day (infiltration) = 25 gpcd + infiltration
 Assume 1 person/200 sq. ft.

8. Light Industrial
 (14,000 gal/acre/day) x 2.5 (peak factor) +
 1200 gal/acre day (infiltration) = 36,200 gpad

gpcd = gallons per capita per day
 gpad = gallons per acre per day

**** The design flows shown above may be adjusted, as approved by the City Engineer, based on unique characteristics of the proposed development or upon presentation of existing flow data.**

- B. If a proposed sewer is to serve a predominantly wet area or an area prone to excessive infiltration and inflow, special design information should be obtained from the City Engineer. If no information is available, the designer should use a minimum of 1000 gpcd for infiltration.
- C. All sanitary sewers shall be a minimum of 8 inches in diameter.
- D. Pipes will be sized to carry peak rates with the pipe flowing at no more than 0.67 of the pipe diameter for pipes 15" and smaller and 0.75 of the pipe diameter for pipes larger than 15" in diameter.
- E. All sewers 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 an "n" value of 0.013.
- F. Where velocities greater than 15 feet per second are calculated, special provisions shall be made to protect against displacement, erosion or shock.
- G. Sanitary sewers shall be sufficiently deep so as to receive sewage by gravity from basements and to prevent freezing.

7.05 SERVICE CONNECTIONS:

- A. All sanitary sewer services shall be in accordance with **Table 7.2.**
- B. A sanitary service pipe will be provided for every platted lot or location where construction of a building is likely. A 4-inch sanitary service pipe will be used for single-family residential. Pipes for multi-family residential, commercial, or industrial, will be sized as required.
- C. Sanitary service pipes will be extended from the main to the right-of-way line or outer utility easement line, whichever is further.

- D. No two sanitary services shall be constructed in the same trench. Service connections shall be separated by a minimum of 6 feet.
- E. The end of all sanitary services shall be marked with a metal post, #4 reinforcing steel, or painted wood 4"x4" at least 24 inches in length buried within one foot of the finished grade.
- F. Service taps in manholes are allowed only in extreme conditions and with the approval of the City Engineer. If permitted, service connections to manholes must be within 24" above the invert elevation of the outlet. Sewer flow channels in the manhole bottom must be provided for all services. Internal drops for service connections may be permitted on manholes deeper than 12 feet upon approval of the City Engineer. Internal drops shall be constructed of SDR 23.5 PVC with stainless steel bands and fasteners spaced at a maximum of 4 feet.

7.06 PIPE STANDARDS AND STRENGTH DESIGN:

- A. **Reinforced concrete pipe** manufactured in accordance with ASTM C-76 and meeting the following standards may be used for pipe 12 inches in diameter or larger.
 - 1. Joints: All joints will be 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.
 - 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. Hydrogen sulfide shall be considered in the design of concrete pipe sewers and may require internal coatings.
- B. **Ductile iron pipe** manufactured in accordance with ANSI/AWWA-C150/A21.50 and ANSI/AWWA-C151/A21.5A and meeting the following standards may be used.

1. Joints: Use push on gasketed joints.
2. Thickness: Use Class 350 AWWA 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.
 - b. Outside of other pipe and fittings: Standard bituminous coating conforming to appropriate ANSI Standard.
- C. **PVC truss pipe** manufactured in accordance with ASTM D2680 and meeting the following standards may be used for pipe 8 inches through 15 inches in diameter.
 1. All PVC truss pipe shall be made of PVC compound having a minimum cell classification of 12454B as defined in ASTM D1784.
 2. Joints: Gaskets shall comply with requirements in ASTM F477 and F913. Joint shall meet the requirements of ASTM D3212.
 3. Pipe shall have a minimum pipe stiffness of 200 psi at 5% deflection per ASTM D2412.
- D. **Polyvinyl chloride (PVC)** manufactured in accordance with ASTM D3034-88 and meeting the following standards may be used for 4-inch and 6-inch services.
 1. Pipe shall be ASTM D3034 with SDR of 26 for 15-inch and smaller.
 2. Rubber ring joints shall conform to ASTM D3212
 3. Minimum pipe stiffness at 5% deflection shall be 46 psi when tested in accordance with ASTM D2412.
 4. Maximum diametrical deflection shall be 5% under load.
 5. Ruber gasket PVC fittings, service wyes, and tees. Solvent welded connections are not acceptable.
 6. All 4" and 6" services shall be SDR 23.5.

E. The designer shall specify pipe material, bedding and trench width to withstand anticipated dead and live loads. Minimum pipe and bedding standards are listed in Table 7.1.

TABLE 7.1

PIPE MATERIAL	SIZE	JOINT	MINIMUM STRENGTH	MINIMUM BEDDING*
<u>Sanitary Sewers</u>				
•Reinforced Concrete	12" & up	See ¶A	Class III, B wall	Class B
•PVC Truss	8"-15"	Gasket	200 psi	Crushed stone encasement
•PVC	8"-15"	Gasket	SDR 26	Crushed stone encasement
Ductile Iron	8" & up	Gasket, push	Class 350	Class B
<u>Sanitary Service</u>				
PVC	4" & 6"	Gasket	SDR 23.5	Crushed stone encasement
DIP	4" & 6"	Gasket	Class 350	Class B
*See Figure 7.4.				

7.07 MANHOLE STANDARDS:

- A. Manholes 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.

- B. Drop Connections: An external or internal drop pipe shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert shall be filleted to prevent solids deposition.
- C. Minimum Drop Across 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 two inflow pipes, a 0.2 foot drop is required.
 3. For the same size pipe with a junction of three or more inflow 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.
- D. Bedding: All manholes shall be placed on a minimum of 6 inches of crushed stone bedding.
- E. Materials:
1. Joints: All joints will be confined O-ring gasket meeting ASTM C443.
 2. No lift holes through the entire wall.
 3. Mark date of manufacture.
 4. Inverts: Precast and cast-in-place inverts must provide a channel at least one-half 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 21 inches in diameter and smaller, and 60 inches for pipe greater than 21 inches in diameter.
 6. Castings shall be Neenah R-1670 non-rocking self-sealing or approved equal.

- F. Standard manholes, step details, drop connections and risers are shown in Figures 7.1, 7.2 and 7.3.
- G. All manholes shall be marked with two 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.
- H. If a manhole is in an area subject to surface water inundation, the casting shall be bolted to the cone section with stainless steel anchors. In addition, an exterior Cretex manhole chimney seal (or approved equal) shall be installed that spans from the casting ring to the cone section.
- I. Manholes in paving shall have an interior Cretex manhole chimney seal (or approved equal) that spans from the casting ring to the cone section.
- J. Concrete spacer rings, and metal shims shall be the only materials utilized to adjust manhole frame elevations.

7.08 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, one 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.

7.09 CREEK CROSSINGS:

- A. Sanitary sewers crossing creeks shall be Class 350 D.I.P. encased in reinforced concrete.
- B. Rip rap all disturbed creek banks and bottom after construction.
- C. Encasement shall be no less than 1 foot beneath the natural bottom of the creek. Greater depths may be required by the City Engineer.

7.10 BACKFILL AND BEDDING:

- A. Within right-of-way backfill shall consist of 1 inch clean crushed stone placed in one foot lifts and compacted to 90% modified proctor density or suitable job excavated material placed in one foot lifts and compacted to 90% Modified Proctor Density. Flowable mortar may be used upon written approval of mix design by the City Engineer. **Sand backfill is not permitted.**
- B. In all other areas backfill shall consist of suitable job excavated material placed in one foot lifts and compacted to 85% Modified Proctor Density.
- C. The gradation of bedding material shall be compatible with surrounding soils to prevent migration of fines.
- D. See Table 7.1 and Figure 7.4 for pipe bedding requirements.

7.11 PERFORMANCE & TESTING:

- A. Testing to be performed under the supervision of the City's representative or as otherwise directed by the City Engineer.
- B. All sewers and manholes will be lamped and visually checked for leakage prior to acceptance.
- C. All sanitary sewers, including service pipes, will be air-tested using current ASTM standards prior to acceptance.
- D. All tests will be completed after backfill is complete.
- E. Polyvinyl Chloride Truss Pipe and PVC Pipe shall have a deflection test conducted after the final backfill has been in place at least 30 days. No pipe shall

exceed a deflection of 5%. If the deflection test is to be run using a rigid ball or mandrel, it shall have a diameter equal to 95% of the inside diameter of the pipe and the tests shall be performed without mechanical pulling devices.

7.12 SEWER LOCATION AND EASEMENTS:

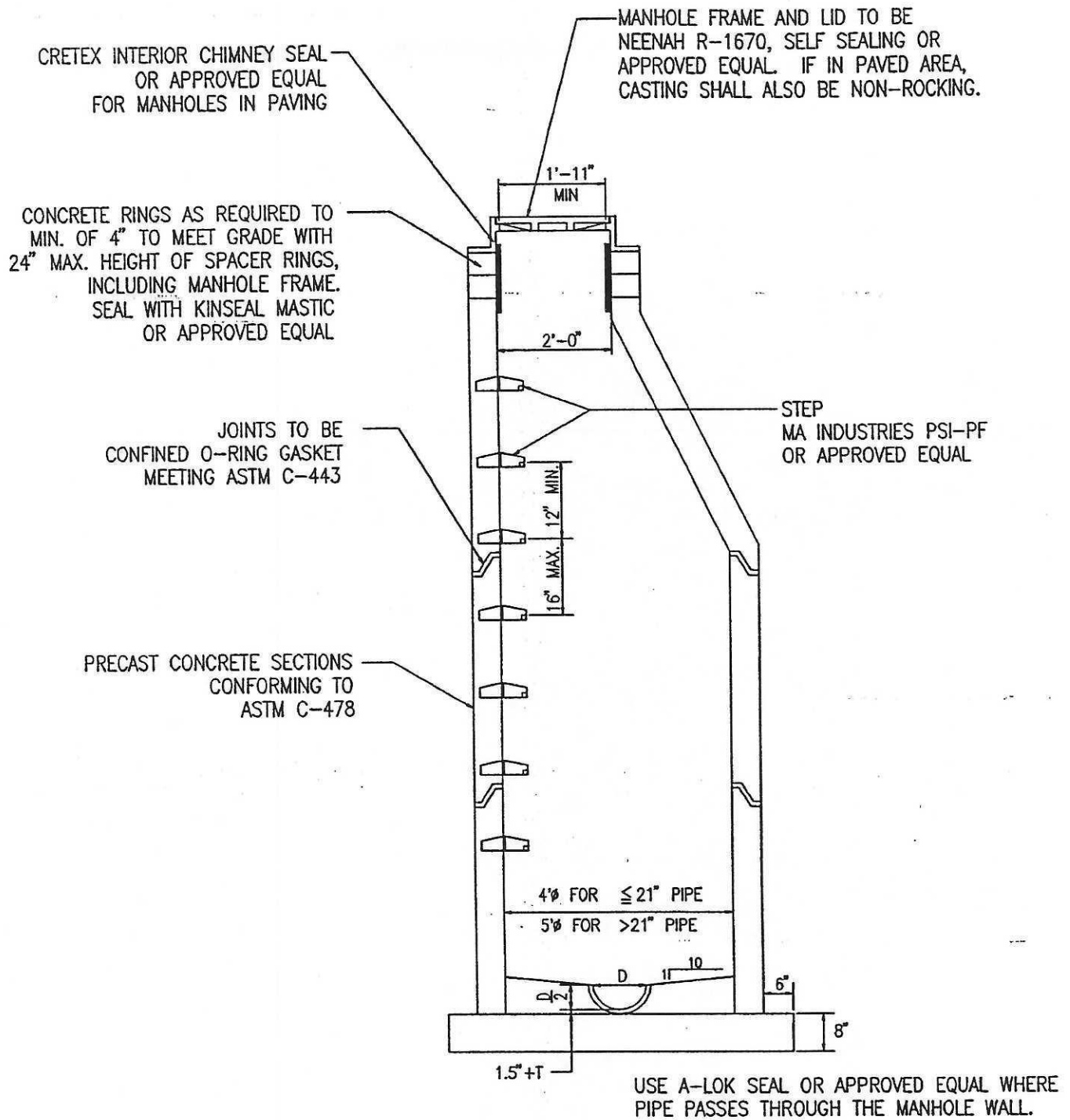
- A. Manholes in street right-of-way must be located in areas which allow direct access by maintenance vehicles. Manholes in areas outside the street right-of-way shall be subject to the approval of the City Engineer in which case access to the manhole shall be along a route in which the transverse slope does not exceed 4% and longitudinal slope does not exceed 12%. Placement of sewers in front yards outside of the right-of-way is discouraged.
- 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 sanitary 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 1.0 times the sewer depth rounded up to the nearest 5 feet.
- D. The minimum easement width is 15 feet.

7.13 LIFT STATIONS & FORCE MAINS:

- A. It is the City's intention and preference to have all extensions or additions to the sanitary sewer collection system be gravity sewer systems. If gravity sewer is not feasible, lift stations shall be designed to have regional service areas.
- B. Telemetered alarm systems are required.
- C. Provisions for the connection of standby power or auxiliary pumping are required.

**TABLE 7.2
SEWER SERVICE CONNECTIONS**

Type	Number of Connections and Size of Service Pipe	Sewer Connection Location
SINGLE FAMILY	1 - 4" Service	Existing Service Connection of Correct Size or Closest Pipe
DUPLEX OR ZERO-LOT LINE	1 - 6" Services or 2 - 4" Services	Existing Service Connection of Correct Size or Closest Pipe
TOWNHOUSE OR MULTIPLE SIDE-BY-SIDE APTS.	1 - 6" Service for Each 2 Units or 1 - 4" Service Per Unit	Existing Service Connection of Correct Size or Closest Pipe
MULTI-STORY APARTMENTS MAX. 6 UNITS	1 - 6" Service (Max. 6 Units) or 1 - 4" Service for each 2 units	Existing Service Connection of Correct Size or Closest Pipe
MULTI-STORY APARTMENTS 7 UNITS OR MORE	1 - 8" Service (Max. 12 Units) or 1 - 6" Service per 6 Units or 1 - 4" Service per 2 Units	Existing Service Connection of Correct Size or Closest Pipe. May require larger private service line built to City Standards.
COMMERCIAL OR MIXED USE DEVELOPMENT	Requires City Engineer Approval. Must be sized for per IDNR requirements.	Requires City Engineer Approval. May require larger private service line built to City standards.



TYPICAL

SANITARY SEWER AND STORM SEWER MANHOLE

GREATER THAN 6' IN DEPTH

FIGURE 7.1

MANHOLE FRAME AND LID TO BE NEENAH R-1670, SELF SEALING OR APPROVED EQUAL. IF IN PAVED AREA, CASTING SHALL ALSO BE NON-ROCKING.

CRETEX INTERIOR CHIMNEY SEAL OR APPROVED EQUAL FOR MANHOLES IN PAVING

CONCRETE RINGS AS REQUIRED TO MIN. OF 4" TO MEET GRADE WITH 24" MAX. HEIGHT OF SPACER RINGS, INCLUDING MANHOLE FRAME. SEAL WITH KINSEAL MASTIC OR APPROVED EQUAL.

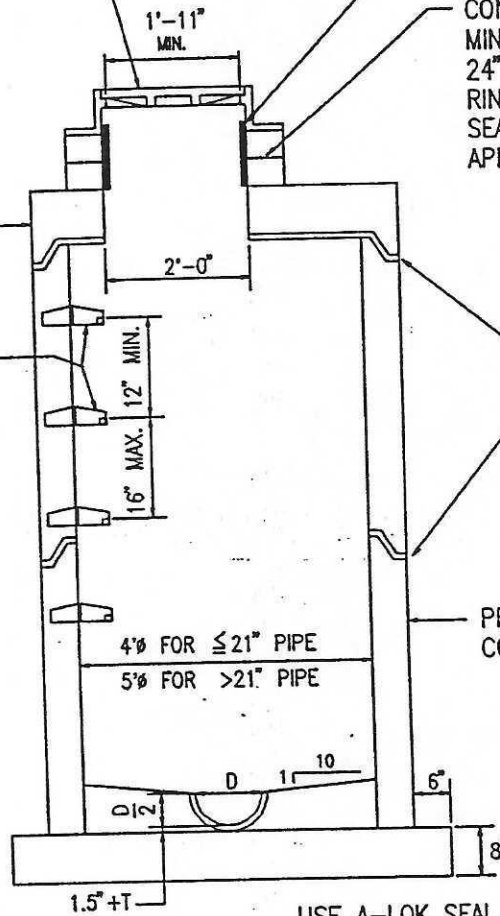
FLAT TOP

STEP
MA INDUSTRIES PSI-PF
APPROVED EQUAL

STEPS ARE NOT
REQUIRED IN
STORM SEWER
MANHOLE, LESS
THAN 3' FEET
DEEP.

JOINTS TO BE
CONFINED O-RING GASKET
MEETING ASTM C-443

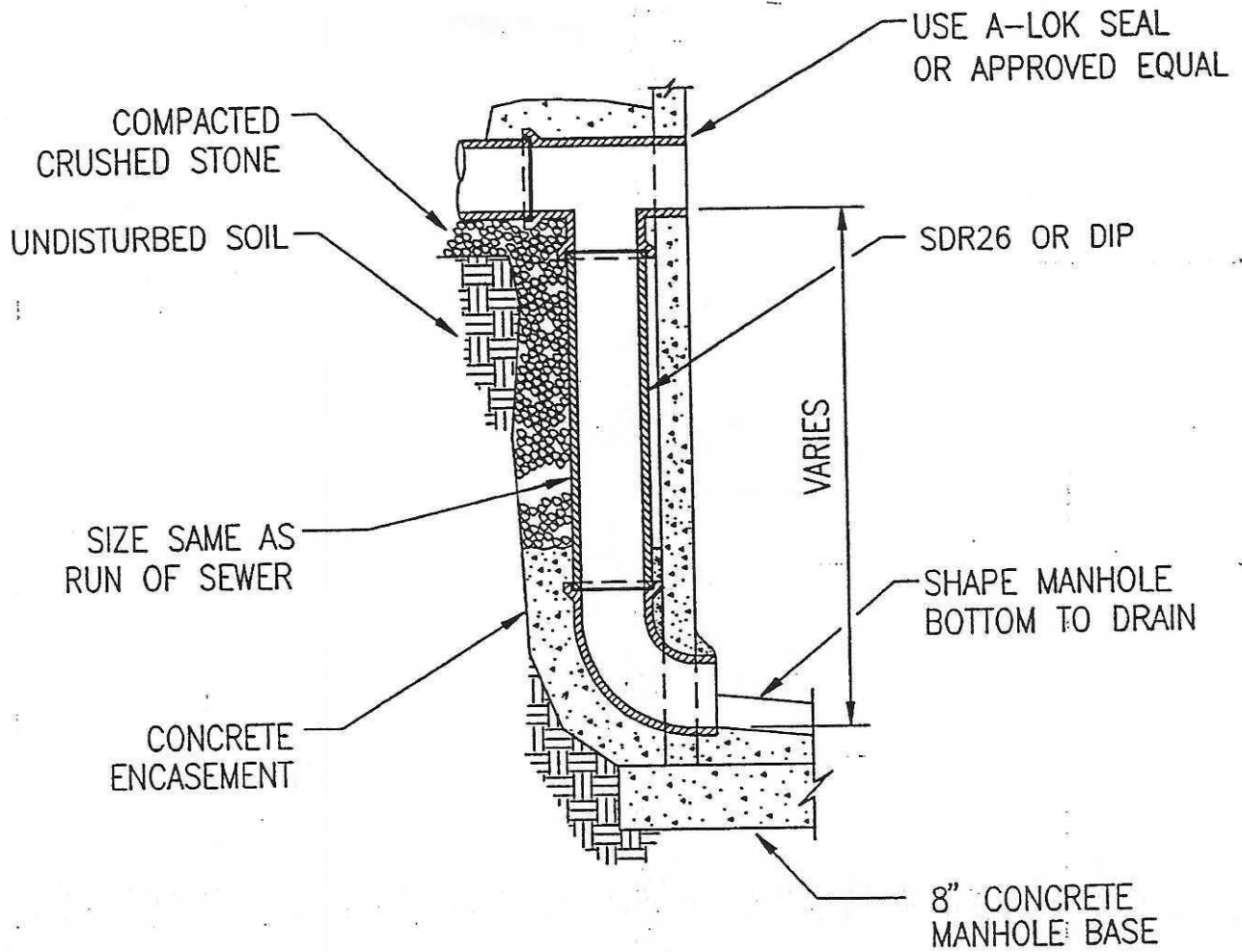
PRECAST CONCRETE SECTIONS
CONFORMING TO ASTM C-478



USE A-LOK SEAL OR APPROVED EQUAL WHERE PIPE PASSES THROUGH THE MANHOLE WALL.

TYPICAL
SANITARY SEWER AND STORM SEWER MANHOLE
6' OR LESS IN DEPTH

FIGURE 7.2

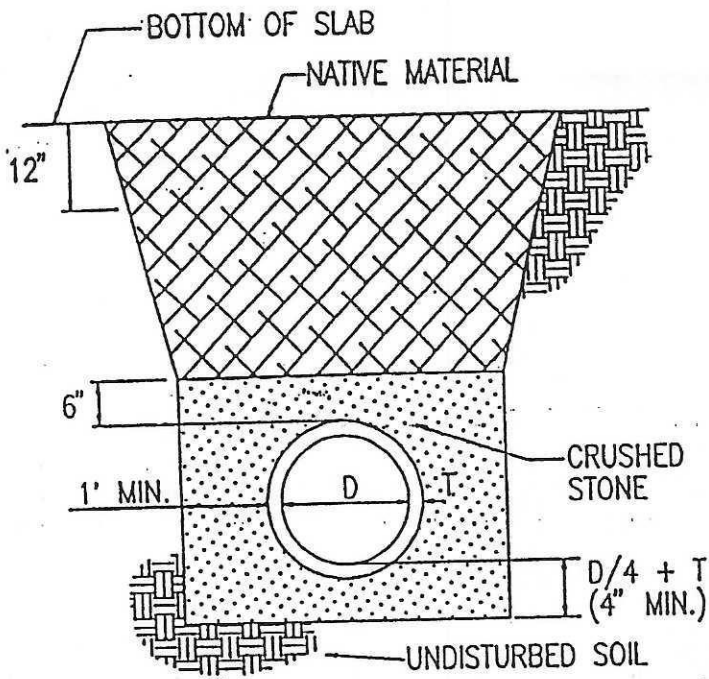


NOTES

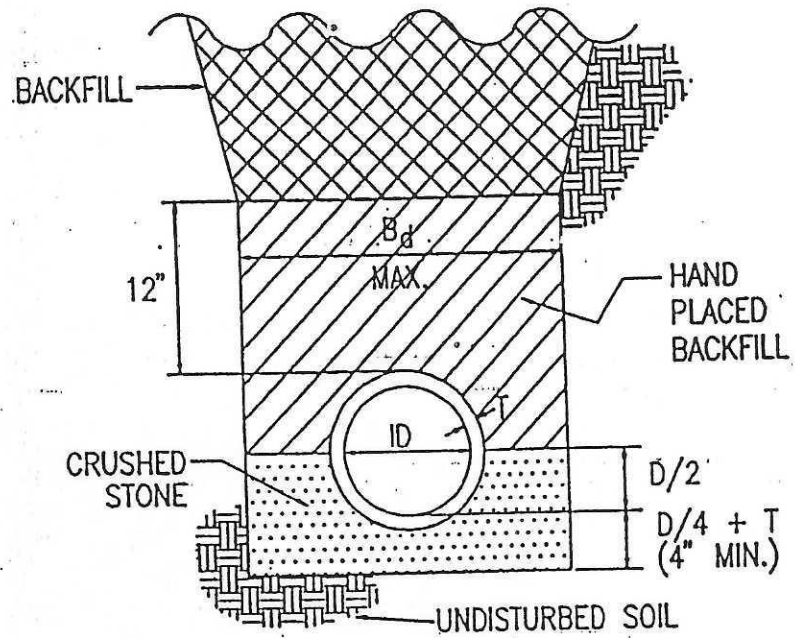
1. MINIMIZE DISTANCE TO UNDISTURBED SOIL AROUND DROP CONNECTION.
2. DROP CONNECTION TO BE USED FOR ALL PIPE ENTERING MANHOLES MORE THAN 24" ABOVE OUTLET PIPE.
3. FOR GENERAL DIMENSIONS OF MANHOLE, SEE TYPICAL MANHOLE DRAWING.

SANITARY DROP CONNECTION

FIGURE 7.3



CRUSHED STONE ENCASEMENT



CLASS "B" BEDDING

ID INCHES	B _d FEET & INCHES
4	2-0
6	2-0
8	2-3
10	2-3
12	2-3
15	2-9
18	3-0
21	3-3
24	3-6
27	4-0
30	4-3
36	4-9
42	5-6
48	6-3
54	7-0
60	7-9
66	8-6
72	9-3
78	10-0
84	10-9

ALLOWABLE TRENCH WIDTHS

1. PIPE SHALL BE PLACED ON CRUSHED STONE MATERIAL.
2. BELL HOLES SHALL BE HAND SHAPED SO THAT ONLY PIPE BARREL RECEIVES BEARING PRESSURE.
3. PLACE BEDDING TO ENSURE THAT THERE ARE NO VOIDS UNDER OR ALONGSIDE THE LENGTH OF PIPE.
4. BACKFILL SHALL BE HAND TAMPED UP TO 12" ABOVE TOP OF PIPE.
5. SEE TABLE FOR ALLOWABLE TRENCH WIDTH B_d

FIGURE 7.4

PART 8 - STORM SEWERS AND STORMWATER MANAGEMENT FACILITIES

8.01 APPROVALS, PERMITS, AS-BUILTS, AND MAINTENANCE BONDS:

- A. Storm water management plans and calculations shall be required of all subdivisions (resubdivisions, developments and related improvements). The City may waive this requirement, on a case by case basis, for smaller subdivisions.
- B. 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.
- C. Plans and specifications for public facilities must be reviewed and approved by the City prior to construction. Calculations must be provided at the same time as other submittals.
- D. 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 before construction.
- E. The Engineer of Record is responsible to submit "Record of Construction" drawings to the City on reproducible velum or mylar, and electronic CAD disc for city mapping updates.
- F. A two-year maintenance bond covering defective materials and workmanship is required for all storm sewer and storm water management facilities to be dedicated to the city.

8.02 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.
- D. Only ground water is permitted in sump pump discharge tiles less than 12 inches in diameter. No surface water or roof drains are permitted in these systems.

8.03 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 five-year return frequency flow except for pipe used to discharge water from storm water management facilities (see 8.12).

If the five-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 two flows.
- E. The minimum size for any storm sewer receiving surface water is 12 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 greater than 15 feet per second are calculated, 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 two pipe joints shall be tied together in all instances.

8.04 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.

8.05 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 inch in length buried to within one foot of the finished grade.

8.06 INTAKES AND DRAINAGE OF STREETS:

A. All intakes on public streets will be designed to the IDOT Type RA standards.

B. DOT RA type area intakes are allowed on storm sewer laterals.

- C. Intakes shall be spaced so that for a five (5) year storm arterial streets shall have two traffic lanes free of excess water at all times. Local and collector streets shall be designed to have one twelve (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 one hundred (100) year storm, the ponding of surface water on local, collector, and arterial streets must not exceed a depth of one (1) foot at the gutter. Water exceeding one (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 8.08 B).

8.07 PIPE STANDARDS AND STRENGTH DESIGN:

- A. **Reinforced concrete pipe** meeting the following standards may be used for pipe 12 inches in diameter or larger.
 - 1. Joints
 - a. Circular pipe: All joints will be 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 will be sealed using an approved mastic material and each joint shall be wrapped with 24 inches of approved filter fabric. If the Hydraulic grade line is less than 6 inches above the top of the pipe during the 100-year event, mastic joint material may be omitted.
 - 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 ANS A21.4.
 - b. Outside of other pipe and fittings: Standard bituminous coating conforming to appropriate ANS 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 Class B or as shown in Figure 7.4.
- E. See pipe bedding diagrams, Figure 7.4

8.08 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 500 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 and shall include RF14 ties.

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 two pipes, a 0.2 foot drop is required.
3. For the same size pipe with a junction of three 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 one-half 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. 72 inch diameter manholes may be required for pipes greater than 36 inch in diameter. Reducers may be used above the chamber section of 60 inch and 72 inch manholes. Precast T's may be used on pipes 48 inch and larger in diameter.
 6. Castings shall be Neenah R-1670 non-rocking self-sealing or approved equal.
- E. Standard manholes, step details, and risers are the same as for sanitary sewers as shown in Figures 7.1, 7.2 and 7.3, except cretex chimney seals are not required.
- F. All manholes shall be marked with two 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. Manholes in paving shall have an interior Cretex manhole chimney seal (or approved equal).
- H. 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.

8.09 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, one 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.

8.10 MINIMUM COVER AND BACKFILL AND BEDDING:

- A. The minimum cover for storm sewers shall be 1 foot below the bottom of pavements and 2 foot below the surface or 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 one foot lifts and compacted to 90% modified proctor density or suitable job excavated material placed in one 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. Sand backfill is not permitted.
- C. All other areas - backfill shall consist of suitable job excavated material placed in one foot lifts and compacted to 85% Modified Proctor Density.

8.11 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 inch 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.

8.12 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 10 feet.
- E. Drainage-way 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 drainage-way and any necessary overbank areas.

8.13 STORMWATER MANAGEMENT FACILITIES:

- A. Storm water management facilities shall be required for new subdivisions and resubdivisions in order to ensure public safety and avoid property damage from excessive runoff. The City may, on a case

by case basis, waive this requirement for developments with 3 acres or less in size.

B. Detention Requirements:

1. New developments that require storm water management shall be required to detain the difference in the volume between the five-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 five-year undeveloped storm.

C. Methodology:

1. The SCS TR-55 computerized runoff volume program or other technically proven method 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. Location and Design Criteria:

1. 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.
2. Dry-bottomed detention facilities shall be oversized by 10% to help offset anticipated sedimentation prior to total watershed development.
3. Maximum side slopes of dry bottom facilities shall not exceed 3.5:1.
4. 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 12 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.

PART 9 - EROSION CONTROL

9.01 APPROVALS AND PERMITS:

- A. Erosion control plans must be certified by a professional engineer registered in the State of Iowa.
- B. Erosion control plans must be reviewed and approved by the City prior to any 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 before construction.

9.02 THRESHOLDS:

- A. Residential developments consisting of subdivisions and re-subdivisions larger than one acre in size will require an erosion control plan.
- B. Commercial and industrial developments greater than one acre in size will require an erosion control plan.

9.03 REQUIREMENTS:

- A. Erosion control plans shall be designed with the following general goals in mind:
 - 1. To protect the site from the significant loss of soil and top soil due to erosion.
 - 2. To protect downstream properties and facilities from the deposition of sediments.
 - 3. To protect onsite facilities and public improvements from damages due to erosion.
 - 4. To protect water quality.

B. The erosion control plans will designate an individual, including name, title, address and phone number, to be responsible for the following duties throughout the duration of the project:

1. Initial installation of the erosion control measures specified by the erosion control plan.
2. Site inspections on a weekly basis and after rains greater than ¼" to assess the effectiveness of existing erosion control measures and to direct installation of additional erosion control measures in response to problems noted during said inspections. The designated individual will keep a log of the inspections and any corrective measures taken. No inspections are required while the ground is frozen or there is snow cover. Inspections will resume when the snow begins to melt. Inspections will continue until adequate ground cover is established to control erosion.

9.04 SUBDIVISION CONSTRUCTION:

During the development of the subdivision, the subdivider shall be responsible for:

- 1.) Disturbance to existing trees and vegetation shall be minimized. All roadways shall be designed to avoid running over the drip lines of any favored trees on the site. The subdivider shall attempt to save all trees, shrubs, and natural grasses. Homeowners will be encouraged to do the same.
- 2.) If the grading contractor stops operation for more than 10 days, stabilization seeding will be done on all disturbed surfaces in accordance with the Erosion Control Plan.
- 3.) Mulch, fertilizer and seeding guidelines will follow those recommended by the Iowa Department of Transportation current Standard Specifications, and/or recommendations from the local Natural Resources Conservation Service office.
- 4.) All disturbed areas in any proposed right-of-way shall be seeded immediately after construction is completed. Erosion control matting shall be installed in sloped areas as directed by the City Engineer. If erosion occurs during construction, measures will be taken to correct the situation.

9.05 HOUSE CONSTRUCTION:

Lots will be independently sold to homebuilders or individuals for development. During construction of the individual homes, the homebuilder or the homeowner will be responsible for the following:

- 1.) All temporary stockpiled soils from building operations will be placed in areas of least slope and located away from concentrated flows of water. All excavated materials shall be covered or impounded with staked hay bales or silt fences to prevent soil erosion.
- 2.) When needed silt fences will be placed around the construction sites as identified on the Soil Erosion Control Plan.
- 3.) All erosion and sediment control measures will be inspected weekly and after each rainfall to locate damages and conduct maintenance operations.
- 4.) Crop residue and existing vegetation will be utilized to control sheet and rill erosion within lot boundaries. After any construction is started all disturbed areas will be monitored and seeded as required.
- 5.) Individual homeowners will be required to take adequate measures to prevent excessive erosion caused by water runoff from drains, downspouts, or tiles.
- 6.) These Soil Conservation practices, detailed above, shall be incorporated into any Covenants and Restrictions pertaining to the land.

9.06 METHODS:

- A. Methods of erosion control shall be consistent with those outlined in the Iowa Construction Site Erosion Control Manual or other commonly accepted engineering practices.
- B. The plan shall include provisions for responding to unanticipated erosion problems as they arise during the construction process.
- C. Special care shall be taken to prevent erosion behind the curbs and beneath the pavement of streets.

PART 10 - ROADWAY LIGHTING

10.01 REQUIRED LUMEN OUTPUT

The required lumen output is as follows:

<u>Roadway Classification</u>	<u>Luminaire</u>
Local	8,500 lumen ASA Type III
Collector	14,500 lumen ASA Type III
Arterial	23,000 lumen ASA Type III

10.02 MOUNTING HEIGHT

The mounting height shall not be less than 26 feet, and no greater than 30 feet.

10.03 LIGHT SOURCE

The light source shall be high pressure sodium or metal halide.

10.04 THE LIGHT SOURCE SHALL MEET ILLUMINATION ENGINEERING SOCIETY (IES) TYPE II "SHARP CUTOFF" LIGHTING CRITERIA (LIMITED "FUGITIVE LIGHT" AND DIRECT DOWNWARD ILLUMINATION).

10.05 THE GENERAL CRITERIA FOR THE LOCATION OF STREET LIGHTS ARE AS FOLLOWS:

1. A street light at all intersections.
2. Street lights at mid-block locations if the blocks are more than 600 feet in length.
3. Closer spacing of street lights in problem areas such as major arterials or high pedestrian areas, as determined by an engineering study.