

PART 1 - GENERAL

1.01 ABOUT THESE STANDARDS

These Design Standards are based on a standard developed for use in the design of most common public improvements, most development activities and utility work within the public right-of-way. The intent of this document is to set a standard of design for the City of Waverly that is consistent, effective, efficient and protects public safety.

These standards are updated on a regular basis, so it is important to have the current edition. Please do not make copies of these standards because only originals are tracked and notified of revisions.

1.02 HOW TO USE THESE STANDARDS

The standards contained in this document are organized into sections covering specific areas of design. It will often be necessary to use a number of sections for the design of a single project. For instance, the design of a street may require the use of standards on streets, sidewalks, storm sewers, traffic-control signals and erosion control.

These standards are a guide for design, but not a substitute for good engineering. It is the obligation of the designer to use these standards responsibly and professionally to produce designs conforming with commonly accepted engineering practices and the Code of Professional Conduct. It will at times be desirable and/or necessary to vary from the standards in this document to produce a good product. When the need arises, please refer to the following section on variances.

1.03 VARIANCES

When it becomes necessary or desirable to vary from the standards presented in this document, a variance may be requested from the City Engineer. Such a request shall be made in writing and will include:

1. The standard to be varied.
2. The proposed variation.
3. Justification for the variance.

A written response will be given within 7 business days of the request.

A driveway width variance which is denied by the City Engineer may be appealed to the Board of Adjustment for consideration in accordance with the Board's process for filing an application for hearing. Any other variance petition which is denied by the City Engineer may be appealed to the City Council, in writing, within 30 days of receiving written notification of the Engineer's decision. The Council will schedule a hearing on the matter at the earliest possible date that is agreeable to all interested parties.

1.04 AMENDMENTS

Amendments to these standards may be requested by writing the City Engineer with details and justification for an amendment. City officials will meet periodically to discuss proposed amendments and make recommendations to the City Council.

1.05 WHOM DO I CONTACT?

Questions regarding these design standards should be directed to:

Mike Cherry, P.E.
City Engineer
200 1st Street NE
P.O. Box 616
Waverly, IA 50677

(319)352-9065
Fax: (319)352-5772

PART 2 - SIDEWALKS AND TRAILS

2.01 APPROVALS AND PERMITS

A sidewalk construction permit must be obtained from the Public Works Administration for all sidewalk construction not associated with the construction of a new house or business for which a building permit has been obtained. However, the standards set forth in this document apply to all sidewalk construction.

2.02 TRAFFIC CONTROL

The contractor shall provide lighted barricades to protect pedestrians.

2.03 WIDTH AND LOCATION

- A. Sidewalk width shall be as defined in Table 2.1, except as noted in Section 2.05.

TABLE 2.1

STREET CLASSIFICATION	WIDTH REQUIREMENTS
Local	4'
Collector	4'
Arterial	4' ¹
Commercial	As directed by the City Engineer
Industrial	4' ²
Major Bridges	8'
¹	A 4' walk will be required on one side and an 8' walk on the other. The City Engineer will designate which side the 8' walk will be on.
²	If required.

- B. Sidewalks shall be located within the ROW and 12 inches from the property line, except in areas in which a different offset is required to match existing sidewalks.
- C. No sidewalks shall extend to the street perpendicular to the curb except at intersections and designated mid-block crossings. Such existing sidewalks removed for construction or maintenance activities shall not be replaced.
- D. Sidewalks are generally required on both sides of all streets.

2.04 CROSS SLOPE

- A. All sidewalks shall slope to the street at a rate of $\frac{1}{4}$ inch per foot.
- B. The street edge of the sidewalk shall be located above the curb approximately $\frac{1}{2}$ inch for every foot horizontally from the curb.

2.05 MATCHING EXISTING SIDEWALKS

- A. The width and location of new sidewalks shall be varied to match the width and location of existing sidewalks in the area; however, the sidewalk width shall not be reduced to less than 4 feet.
- B. Sidewalk cross slope may be varied through a gradual transition to match existing adjoining sidewalks. Contact the City Engineer if existing adjoining sidewalks vary significantly from existing standards.

2.06 MATERIAL AND THICKNESS

- A. Sidewalks shall be constructed of Portland cement concrete conforming to the Iowa Department of Transportation Class C mix. Maximum slump shall be 3 inches.
- B. Sidewalks 4 to 6 feet wide shall have a minimum thickness of 4 inches. Sidewalks greater than 6 feet wide shall have a minimum thickness of 5 inches. Sidewalks crossing driveways shall be a minimum of 6 inches thick.

2.07 JOINTS AND FINISH

- A. Sidewalks shall have a uniform texture with a broom finish.
- B. Tooled joints are not permitted.
- C. Sawed joints are required for all widths of sidewalks. The joint depth shall be $\frac{1}{3}$ the sidewalk thickness.
- D. Longitudinal sidewalk joints shall be delineated through driveways.
- E. Sidewalk joints shall be spaced to form square panels.
- F. Prefomed expansion joints, $\frac{1}{2}$ inch in width, shall be installed at approximately 100-foot intervals or at property lines in new residential or commercial construction. Prefomed expansion joints, $\frac{1}{2}$ inch in width, shall be installed adjacent to all curb ramps. See Figure 2.1.
- G. Stamped imprints indicating the contractor and date of construction are permissible. The size of the imprint shall be limited to less than 4 inches x 6 inches and the depth to less than $\frac{1}{4}$ inch.

- H. Apply curing compound immediately following finishing operations or cure with moist burlap for not less than 24 hours.

2.08 CURB RAMPS

- A. Sidewalks shall provide a curb ramp for accommodation of the disabled at all intersections and designated crossings.
- B. Curb ramps shall be located in line with the public sidewalk as shown in Figure 2.1.
- C. Curb ramps shall be at least 48 inches wide between the curbs and should be sloped at not greater than 1 inch of rise per 12 inches linear distance (8.3%). A slope no greater than 1 inch of rise per 8 inches linear distance (12.5%) may be used where necessary. The cross slope of curb ramps shall not exceed 2%.
- D. The current standards of the Americans with Disabilities Act (ADA) will govern in all cases.

2.09 TRAILS

- A. In general, trails shall be designed to the same standard as sidewalks.
- B. Trails designed for public use shall be a minimum of 8 feet wide.
- C. To the extent practicable, trails shall comply with the provisions of the Americans with Disabilities Act (ADA).
- D. The trail surface shall be of one of the designs shown in Figure 2.2. Surfaces other than Portland cement concrete will require approval of the City Engineer. Where water is expected to overtop the trail, only non-erodible surfaces shall be used.
- E. Trails designed for the use of bicycles shall be designed to the standards of the American Association of State Highway and Transportation Officials' Guide for the Development of Bicycle Facilities.
- F. Trails that also serve as vehicular access for utility maintenance activities shall be constructed of Portland cement concrete and have appropriately designed radiuses.

PART 3 – DRIVEWAYS

Part 3 Revised 5/31/06

3.01 APPROVALS AND PERMITS

- A. An access permit must be obtained before driveway construction or reconstruction not associated with the construction of a new house or business for which a building permit has been obtained. However, the standards set forth in this document apply to all driveway construction. A sketch with dimensions shall be submitted showing the driveway in relation to intersections, side lot lines and other driveways.
- B. A permit must be obtained from the Iowa Department of Transportation before placing a driveway within any state highway right-of-way.

3.02 TRAFFIC CONTROL

- A. The contractor doing the work is responsible for all traffic control and work-site safety. If construction activities extend onto the street, traffic control shall meet the standards for Work Zone Traffic Control defined in the current edition of the Manual on Uniform Traffic Control Devices. Traffic control plans may be required.
- B. The contractor shall provide adequate lighted barricades and/or fencing to protect pedestrians.

3.03 DRIVEWAY MATERIAL, THICKNESS AND FINISH

- A. The driveway slab extending from the street to private property shall be constructed of Portland cement concrete conforming to the specifications of the Iowa Department of Transportation Class C or M mixes. Maximum slump shall be 3 inches. The concrete driveway slab shall be a minimum of 6 inches thick.
- B. Driveways shall have ½-inch preformed expansion joint material at the front and back of the sidewalk and at the back of the curb.
- C. The finish shall be a broom finish or Astroturf drag.
- D. Apply curing compound immediately following finishing operations or cure with moist burlap for not less than 24 hours.

3.04 CURB REMOVAL AND JOINT AT PAVEMENT

Curb drops shall be constructed as detailed in Figure 3.1.

3.05 GENERAL CONDITIONS FOR ALL CLASSIFICATIONS OF DRIVEWAYS

- A. There shall be a minimum of 20 feet between the end of the radius of a street intersection and the beginning of a driveway curb cut as measured at the curb line in all instances. Additional distance between the radius of a street intersection and the beginning of a driveway curb cut may be required by the City Engineer where deemed necessary because of high-traffic volumes or other safety concerns.
- B. A 6-foot minimum distance between curb cuts at the curb line will be required.
- C. The curb return shall not be constructed closer than 3 feet to the side property line extended.
- D. Unless noted otherwise, all driveways shall be constructed with flared approaches. Special approval must be obtained from the City Engineer to construct approaches with rounded radii.
- E. The minimum distance a driveway shall be to a side lot line is 5 feet, unless it is a joint driveway.

3.06 SINGLE FAMILY (Figure 3.2)

- A. One driveway with maximum dimensions of 32 feet measured at the street side of the sidewalk and 32 feet at the curb line will be allowed.
- B. A maximum of 2 driveways per property will be allowed, regardless of single or double frontage (regular or corner lot).
- C. If 2 driveways are desired on a single frontage lot, 2 driveways with maximum dimensions of 12 feet measured at the street side of the sidewalk and 18 feet at the curb line will be allowed.
- D. If 2 driveways are desired on a double frontage (corner) lot, 1 on each frontage, 1 driveway with maximum dimensions of 32 feet measured at the street side of the sidewalk and 32 feet at the curb line and 1 driveway with maximum dimensions of 12 feet measured at the street side of the sidewalk and 18 feet at the curb line will be allowed. The major (larger) driveway is required to be located on the lower classified street.
- E. Shared driveways for adjacent single-family residences are encouraged and in some instances may be required. To promote this goal, shared driveway maximum widths of 32 feet at the street side of the sidewalk and 36 feet at the curb line will be allowed.
- F. Sections 3.05(B) and 3.05(C) may be varied by the City Engineer in certain instances in the existing developed areas of the City as necessary.

3.07 TWO-FAMILY RESIDENCES (Figure 3.3)

- A. A maximum of 1 driveway per dwelling unit will be allowed, regardless of single or double frontage (regular or corner lot).
- B. One driveway per dwelling unit with maximum dimensions of 32 feet measured at the street side of the sidewalk and 32 feet at the curb line will be allowed, except as noted in 3.06(F).
- C. If garages are constructed on the common lot line, a single driveway with maximum widths of 32 feet at the street side of the sidewalk and 36 feet at the curb line will be allowed.
- D. Sections 3.05(B) and 3.05(C) may be varied by the City Engineer in certain instances in the existing developed areas of the City as necessary.

3.08 ALL OTHER DRIVEWAYS EXCEPT SINGLE OR TWO-FAMILY RESIDENCES

- A. Single Frontage (Figure 3.4)
 - 1. One driveway with maximum dimensions of 34 feet measured at the street side of the sidewalk and 42 feet at the curb line will be allowed.
 - 2. If 2 driveways are desired, 2 driveways with maximum dimensions of 24 feet measured at the street side of the sidewalk and 32 feet at the curb line will be allowed.
 - 3. If the single frontage length is greater than or equal to 150 feet, 2 driveways with maximum dimensions of 34 feet measured at the street side of the sidewalk and 42 feet at the curb line will be allowed.
- B. Corner Lots (Figure 3.5)
 - 1. On corner lots, driveways shall be constructed as far away from the intersection as possible and still remain upon the property. In no case shall there be less than 20 feet between the end of the radius of a street intersection and the beginning of a driveway curb cut as measured at the curb line.
 - 2. In no instance shall more than 3 driveways be allowed on a double frontage property with no more than 2 on any single frontage.
 - 3. One driveway per frontage with maximum dimensions of 34 feet measured at the street side of the sidewalk and 42 feet at the curb line will be allowed.
 - 4. If 1 frontage length is greater than or equal to 150 feet, 2 driveways with maximum dimensions of 34 feet wide at the property or sidewalk line and 42 feet at the curb line will be allowed on the longer frontage.

3.09 STATE HIGHWAY AND INDUSTRIAL AREAS (NON-RESIDENTIAL) (FIGURE 3.6)

- A. Type A drives are for high-traffic volume, joint or common property driveways requiring protection for left-turn movements. Type A drives shall be 45 feet wide at the property or sidewalk line. This width contains one 16-foot lane in a 4-foot painted or raised median and two 12-foot lanes out.
- B. Type B drives are for high-traffic volume, joint or common property driveways. Type B drives shall be 41 feet wide at the property or sidewalk line. This width contains one 16-foot lane in and two 12-foot lanes out.
- C. Type C drives are for lower-volume single property driveways. Type C drives shall be 28 feet wide at the property or sidewalk line. This width contains one 14-foot lane in and one 14-foot lane out.
- D. The maximum radius for all driveways is 25 feet.

3.10 DOUBLE FRONTAGE LOTS – FRONT AND BACK

- A. Each frontage for lots with frontage on 2 parallel streets (through lot) shall comply with the applicable standards for single-frontage lots contained in Sections 3.06, 3.07 and 3.08.
- B. Some subdivisions may prohibit access onto the higher-classification street. Check the subdivider's agreement in each case.

PART 4 - ALLEYS

4.01 APPROVALS, PERMITS, AS-BUILTS AND MAINTENANCE BONDS

- A. Plans and specifications for public alley improvements 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 alley improvements 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 vellum or Mylar and a digital base map in an AutoCAD file or other approved electronic format.
- E. A 4-year maintenance bond covering defective materials and workmanship is required for all alley improvements.

4.02 ALLEY CLASSIFICATION

- A. A **Residential Alley** is a route located between local streets used primarily for access to the rear of residential property.
- B. A **Commercial Alley** is a route located in commercial areas used primarily for access to the rear of commercial property.

4.03 RIGHT-OF-WAY WIDTH

The right-of-way width shall be 20 feet for all alleys.

4.04 PAVEMENT WIDTH

- A. Residential alleys shall have a pavement width of 18 feet.
- B. Commercial alleys shall have a pavement width of 20 feet.

4.05 ALLEY GRADES

The maximum grade for alleys shall be 12% for residential and 10% for commercial alleys. The minimum grade shall be 0.5% for all types of alleys.

4.06 ALLEY PAVEMENT CROSS SECTION

The pavement shall have a 4% inverted crown cross section.

4.07 PAVEMENT MATERIAL AND THICKNESS

- A. The pavement slab may be constructed of the following materials:
 - 1. Non-reinforced Portland cement concrete conforming to the IDOT specifications Class C or M mix as applicable.
 - 2. Full-depth hot mix asphalt conforming to the IDOT specifications for Type "B" base and Type "A" surface course.
- B. Minimum alley pavement thickness:

	<u>Residential</u>	<u>Commercial</u>
Portland Cement Concrete.....	6"	7½"
Hot Mix Asphalt.....	7½"	9½"

4.08 SUBGRADE REQUIREMENTS

- A. The subgrade shall be scarified to a depth of 6 inches below the pavement, and compacted to 90% of Modified Proctor Density.
- B. All fill sections shall be compacted to 90% of Modified Proctor Density.

PART 5 - STREETS

5.01 APPROVALS, PERMITS, AS-BUILTS AND MAINTENANCE BONDS

- A. Plans and specifications for public street improvements 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 street improvements 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 Engineer on reproducible vellum or Mylar and a digital base map in an AutoCAD file or other approved electronic format.
- E. A 4-year maintenance bond covering defective materials and workmanship is required for all street improvements.

5.02 DESIGN RESOURCES

- A. A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, current edition.
- B. Iowa Department of Transportation Manuals, current editions with revisions:
 - Standard Road Plans
 - Road Design Details
 - Road Design Manual
 - Road Design Aids Manual
- C. Iowa Department of Transportation Urban Design Guide and Alternative Urban Design Guides, current edition.
- D. Iowa Department of Transportation "Standard Specifications for Highway and Bridge Construction", current edition.

5.03 STREET CLASSIFICATION

Streets will be classified according to their functional use as described as follows. Existing facilities may not fully comply.

Arterial Streets provide a continuous route for the expeditious movement of large volumes of all types of through traffic across and beyond the City and between high-traffic generation points. The geometric design and traffic-control measures are used to facilitate the safe movement of through traffic. Local street access to arterial streets will be limited. Direct access from abutting properties will not be permitted.

Collector Streets provide for the movement of traffic between arterial routes and local streets as well as providing limited direct access to abutting property. Moderate amounts (≤ 2500 vehicles per day) of low speed (≤ 25 MPH) traffic, including bus traffic, may be carried on collector streets.

Local Streets serve as a means of access to abutting property. They are intended to be a low speed (≤ 25 MPH) and short trip routes, with usually less than 500 vehicles per day.

Industrial Streets are intended to carry commercial or industrial traffic.

5.04 RIGHT-OF-WAY WIDTH

- A. The minimum right-of-way width shall be provided as follows:
 - 1. Arterial right-of-ways shall be 100 feet in width.
 - 2. Collector right-of-ways shall be 70 feet in width.
 - 3. Local right-of-ways shall be 60 feet in width.
 - 4. Cul-de-sac right-of-ways shall be 90 feet in diameter for local and 120 feet in diameter for industrial.
 - 5. Industrial right-of-ways shall be 70 feet in width.
- B. These widths do not provide for medians or boulevards if they are planned within the right-of-way.

5.05 TRAFFIC LANE WIDTHS AND LENGTH RESTRICTIONS

- A. All street widths shall be measured back-to-back of the curb.
- B. The minimum traffic lane width will be 12 feet for arterials.
- C. Local streets will have a minimum pavement width of 29 feet with parking restricted to one side.
- D. Collector and industrial streets shall have a minimum pavement width of 37 feet with parking restricted to one side.
- E. Arterial streets shall have a minimum pavement width of 31 feet with no parking permitted on the street.
- F. Cul-de-sacs shall be paved with a minimum radius equal to the pavement width. The other radius from the stem of the cul-de-sac to the head shall be a minimum of

25 feet. Cul-de-sacs shall have a maximum length of 500 feet from the center of the bulb to the centerline of the adjoining street.

- G. Streets shall be extended to the edge of the development when the City determines that it is necessary to facilitate future development.

5.06 SEPARATE TURNING LANES

Separate turning lanes may be included on arterial streets, but will generally not be included in other street design. Where separate turning lanes are required on the basis of a capacity analysis, use a 12-foot width for arterial streets and an 11-foot width for collector streets.

5.07 MEDIANS AND BOULEVARDS

- A. Medians or boulevards on arterial streets shall have a minimum width of 16 feet. At intersections, medians may be used to provide for a separate left-turn storage lane.
- B. Medians or boulevards which are included as a part of local or collector streets shall have a minimum width of 4 feet if paved or 9 feet if grassed. Paved medians on local and collector streets are discouraged.

5.08 DESIGN SPEED

A design speed will be used to design the geometric features for arterial streets. The design speed will not be less than 35 miles per hour; however, posted speed limits may be less. The design speed will be used to establish geometric features including sight distance, intersections, etc. to current AASHTO standards.

5.09 CLEAR ZONES

- A. On streets with curbs, the clear zone shall be 3 feet for streets with a posted speed limit of 25 mph or less, 6 feet for streets with posted speed limits of 35 to 45 mph and 10 feet for streets with a posted speed limit greater than 45 mph. On streets without curbs, the clear zone shall be 10 feet for 2-lane and 4-lane facilities.
- B. For sidewalks and trails, the clear zone shall be 1 foot for sidewalks less than 6 feet in width and 2 feet for sidewalks or trails 6 feet wide and greater.
- C. Variances to clear zone requirements will be considered for overhead electrical facilities where compliance will significantly impact existing trees. In no case will a clear zone of less than 2 feet be allowed. A clear zone variance must be approved by the City Engineer.

5.10 STREET GRADES

- A. The maximum street grade for arterial, industrial and cul-de-sac streets shall be 8%, for collector streets 10% and for local streets 12%.
- B. When 2 streets intersect, the grade of the lower classification street shall be minimized to allow safe stopping and starting in adverse weather.
- C. The minimum grade for streets shall be 0.5%, except around the bulbs of cul-de-sacs where the minimum grade shall be 0.7%.

5.11 CURVE RADIUS

- A. The minimum centerline radius for curves shall be as follows:

arterial	1,000 feet
collector.....	350 feet
local.....	150 feet
cul-de-sacs.....	150 feet
industrial.....	350 feet

- B. Under no circumstances will variances be granted for radiuses less than 75 feet.

5.12 PAVEMENT CROSS SECTION

All pavements shall have a 2% crown cross section as shown in Figure 5.1.

5.13 CURB AND GUTTER SECTION

- A. Curbs shall be 6 inches as shown in Figure 5.1. Roll curbs are not allowed.
- B. Curbs shall be integral cast Portland cement concrete. There shall be no separation between the curb and gutter section and the pavement.

5.14 INTERSECTION CORNER RADIUS

- A. The corner radius at intersections will depend on the functional classification of the intersecting streets. These are the minimum criteria:

arterial - arterial.....	50 feet
arterial - collector.....	30 feet
arterial - local.....	25 feet
collector - collector.....	25 feet
collector - local.....	25 feet
local - local.....	25 feet
industrial.....	50 feet
alley - all.....	Maximum allowable that will remain in the street R.O.W. (not more than 20 feet)

Corner radiuses may be enlarged on routes that will have significant truck or bus traffic.

- B. See Figure 5.2 or 5.3 for typical intersection joint detail. City Engineer will determine which “Typical Intersection Dowling Plan” will be required.

5.15 PAVEMENT MATERIAL AND THICKNESS

- A. The pavement slab shall be constructed of non-reinforced Portland cement concrete conforming to the IDOT specifications Class C or M mix, or hot mix asphalt.
- B. The minimum required pavement thicknesses are as follows:

<u>Street Class</u>	<u>Portland Cement Concrete</u>	<u>Hot Mix Asphalt*</u>
Arterial	9 inches min.	12 inches
Collector and Industrial	7½ inches	9½ inches
Residential	6 inches	7½ inches

Pavement thickness requirements are intended as a guide. Arterial street projects shall be designed on the basis of soil conditions and projected traffic loadings.

*Portland cement concrete curb and gutter sections 30 inches wide are required. Additional thickness for arterial, collector and industrial streets may be required on the basis of soil conditions and traffic loadings.

5.16 SUBGRADE AND FILL SECTION REQUIREMENTS

- A. The subgrade shall be scarified to a depth of 6 inches below the pavement and compacted to 90% of Modified Proctor Density.
- B. All fill sections shall be compacted to IDOT Type A limits.
- C. Some soils may require the use of a drainable base and tile system constructed to IDOT standards. Pavement construction on fully hydric soils or slopes exceeding 8% will require a drainable base and tile system. See Section 5.18 for a list of fully hydric soils. Pavements on other soils will be evaluated on a case-by-case basis. Pavement tile systems may be used for sump pump discharge tiles required by Part 9, Storm Sewers and Storm water Management Facilities.

5.17 AREA BETWEEN THE SIDEWALK AND THE CURB (PARKWAY)

- A. The parkway shall slope to the street at a rate of ½ of an inch vertical per horizontal foot.
- B. In residential areas the parkway shall be grassed except in such areas that the parkway is so narrow that grass does not grow well. In these narrow areas the alternate materials described in Paragraph C may be used upon approval of the City Engineer.
- C. In commercial areas alternate materials may be used in the parkway upon approval of the City Engineer. These materials include exposed aggregate concrete, asphalt and bricks or concrete pavers on an asphalt or concrete base.

**TABLE 5.1
Summary of Design Criteria**

DESIGN STANDARD	ARTE- RIAL	COLLECTOR	LOCAL	CUL-DE- SACS	INDUSTRIAL
Minimum right-of-way width	100'	70'	60'	See Sec. 5.04	70'
Minimum lane width	12'	12'			
Minimum pavement width	31' ¹	37' ²	29' ²	29' ³	37' ²
Maximum grade	8%	10%	12%	8%	8%
Minimum grade	0.5%	0.5%	0.5%	0.7%	0.5%
Minimum curve radius	1,000'	350'	150'	150'	150'
Minimum pavement thickness	9 ⁴ 12 ⁵	7.5 ⁴ 9.5 ⁵	6 ⁴ 7.5 ⁵	6 ⁴ 7.5 ⁵	7.5 ⁴ 9.5 ⁵

- 1. No parking permitted.
- 2. Parking restricted to one side.
- 3. Radius equal to street width.
- 4. Portland Cement Concrete
- 5. Hot Mix Asphalt

5.18 FULLY HYDRIC SOILS

Soils Susceptible to Frost Heaving or High Ground Water:

SCS MAP SYMBOL	SCS MAP UNIT NAME
BaB, BaC, BaD	Backbone
Ck	Clyde
FoB	Floyd
Hm	Hayfield
KeB, KeC, KeC2	Kenyon
Ld	Lawler
OrA, OrB	Oran
OsA, OsB, OsC	Ostrander
ReA, ReB	Readlyn
Sp, Sv	Spillville

PART 6 - UTILITY WORK AND OTHER CONSTRUCTION WITHIN PUBLIC RIGHT-OF-WAY

6.01 PERMIT REQUIRED

A right-of-way construction permit is required to work within the public right-of-way. Permits may be obtained from the Public Works Administration. Permits for utility work must be obtained by the owner of the utility. A right-of-way construction permit is not required for sidewalk, driveway, or mail box construction. See Parts 2 and 3 for the construction of sidewalks and driveways and Section 6.03(A) for the construction of mailboxes.

6.02 TRAFFIC CONTROL

- A. The permittee is responsible for all traffic control and work site safety. Traffic control shall meet the standards for Work Zone Traffic Control as defined in the current edition of the Manual on Uniform Traffic Control Devices for Streets and Highways. A traffic control plan may be required by the City Engineer.
- B. The permittee shall provide adequate lighted barricades and/or fencing to protect pedestrians. All excavations shall be fenced when the contractor is not at the site.
- C. There may be situations where the traffic load or site conditions will allow only a portion of the street to be closed at one time. On collector and arterial streets contractors may be required to bore and jack to place a new utility beneath the street surface.

6.03 MISCELLANEOUS CONSTRUCTION

- A. Mailboxes - The base of all mailboxes shall be a minimum of 18 inches from the edge of the pavement. Brick or other masonry support structures are not allowed. Contact the local post office for current regulations regarding the height and offset of the face of the mailbox.
- B. Retaining Walls - Private retaining walls are not allowed within the public right-of-way without an agreement for temporary use of public right-of-way approved by the City Engineer.
- C. Monitoring Wells - Monitoring wells are allowed in the public right-of-way only when it can be shown that the wells cannot be located on private property. Monitoring wells are subject to special permit conditions.

6.04 CLEAR ZONES

- A. On streets with curbs, the clear zone shall be 3 feet for streets with a posted speed limit of 25 mph or less, 6 feet for streets with posted speed limits of 35 to 45 mph and 10 feet for streets with a posted speed limit greater than 45 mph. On streets without curbs, the clear zone shall be 10 feet for 2-lane and 4-lane facilities.
- B. For sidewalks and trails, the clear zone shall be 1 foot for sidewalks less than 6 feet in width and 2 feet for sidewalks or trails 6 feet wide and greater.
- C. Variances to clear zone requirements will be considered for overhead electrical facilities where compliance will significantly impact existing trees. In no case will a clear zone of less than 2 feet be allowed. A clear zone variance must be approved by the City Engineer.

6.05 EXCAVATION AND BACKFILL

- A. Within public right-of-way, backfill shall consist of Class A crushed stone or suitable job excavated material placed in 1-foot lifts 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; however, sand may be used as utility bedding.
- B. In all other areas backfill shall consist of suitable job excavated material placed in 1-foot lifts and compacted to 85% Modified Proctor Density.

6.06 WORK AROUND TREES

- A. Use care to prevent work within the drip line of trees.
- B. When work falls within the drip line of trees, contact the City Engineer or City Forester.

6.07 RESTORATION OF BRICK STREET SURFACE

- A. Use care to salvage bricks during excavation.
- B. Construct a 7-inch thick base of IDOT Class M concrete. Allow enough depth for installation of brick on a sand cushion.
- C. Brick shall be placed on a sand cushion making sure the pattern and elevation match the surrounding street.
- D. A 50% sand and 50% Portland cement mixture shall be swept into the brick joints and fogged with a mist of water to insure seating of the brick.

6.08 RESTORATION OF ASPHALT OVERLAY ON BRICK STREETS

- A. Construct a 7-inch thick base of IDOT Class M concrete flush with the top of the surrounding bricks.
- B. Tack and place ½-inch IDOT Type A asphalt surface course and compact to the proper elevation.

6.09 RESTORATION OF ASPHALT OVERLAY ON PORTLAND CEMENT CONCRETE STREETS

- A. Construct a concrete base of the same thickness as was removed using Class M mix. An IDOT type BT-3 joint shall be used to joint the base to existing concrete. Use #5 epoxy coated bars, 24 inches in length, spaced 30 inches on center drilled and grouted 9 inches into the existing slab. The concrete base shall be flush with the existing concrete.
- B. Tack and place ½-inch Type A asphalt surface course and compact to the proper elevation.

6.10 RESTORATION OF PORTLAND CEMENT CONCRETE STREETS

- A. Concrete shall be removed to the nearest longitudinal joint and a minimum of half the panel between transverse joints. Only full or half panels may be removed. Full panels must be removed if the portion to remain is cracked or settled.
- B. Concrete shall be sawed to insure a clean break at the joints.
- C. An IDOT type BT-3 joint shall be used to join to the existing concrete. Use #5 epoxy coated bars, 24 inches in length, spaced 30 inches on-center drilled and grouted 9 inches into the existing slab.
- D. Place new concrete of the same thickness as was removed using IDOT Class M mix.
- E. All joints shall be sawed and sealed according to IDOT detail RH-51.

6.11 OTHER SURFACES

- A. All areas outside the paving which are disturbed shall be restored to their original condition.
- B. When approved by the governing authority, unimproved streets (rock or rock and oil, seal coated streets, or hot mix asphalt surfaced streets) may be repaired or restored with Bituminous Seal Coat consisting of 1 or more applications of Binder Bitumen with 1 or more successive applications of cover aggregate. Materials, Equipment and Construction methods shall be in general conformity with Section 2307 of the current Iowa Department of Transportation Standard Specifications for Highway and Bridge Construction.

6.12 MAINTENANCE

- A. Seeding or sodding of disturbed areas shall be maintained until watering is no longer required for self-sustaining growth.
- B. The owner of the utility will be responsible for repair or maintenance of settled areas within the right-of-way and pavement repairs for a period of 2 years from the date the work is completed.

PART 7 - WATER DISTRIBUTION SYSTEM

7.01 APPROVALS, PERMITS, AS-BUILTS AND MAINTENANCE BONDS

- A. Plans and specifications for public water distribution 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 water distribution facilities must be reviewed and approved by the City Engineer prior to construction.
- C. Plans and specifications for public water distribution 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 Engineer before construction.
- D. The Engineer of Record is responsible to submit "Record of Construction" drawings to the City Engineer on reproducible vellum or Mylar and a digital base map in an AutoCAD file or other approved electronic format.
- E. A 4-year maintenance bond covering defective materials and workmanship is required for all water main improvements.

7.02 DESIGN RESOURCES

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

- A. Requirements and Standards of the Iowa Department of Natural Resources.
- B. City's Construction Specifications.
- C. City's Plumbing Code.
- D. Conflict - In case of a conflict between the above design standards, the most restrictive requirement shall apply.

7.03 DEFINITIONS

- A. A **Distribution Main** means a water pipe owned, operated and maintained by the City, which is used for the purpose of distribution of water and from which service connections are made.
- B. A **Private Service Pipe** means a water pipe installed, owned, operated and maintained by the private consumer. Service pipes are often 1 inch in size for residential and may be 2 to 6 inches in size for commercial or 8 to 12 inches for large industrial applications.
- C. A **Private Fire Hydrant** is one which is located on privately-owned property or on streets not dedicated to public use unless the water main is within a public

easement. Private fire hydrants must be served by a minimum of a 6-inch pipe. A private fire hydrant is the responsibility of the property owner and is to be used for fire protection only. Where it is the owner's intention that these hydrants be used by the City Fire Department, these hydrants shall conform to the Department of Public Works specifications for fire hydrants. The City has the right to utilize the hydrants for flushing purposes.

7.04 CONSTRUCTION SPECIFICATIONS

Construction must comply with the City's standard construction specifications for water distribution facilities.

7.05 SYSTEM DESIGN

- A. **Size:** All mains shall be a minimum of 8 inches in diameter. A larger size may be required by the City Engineer, depending upon water demand and fire flows.
- B. **Depth:** Water main shall be installed with a minimum depth of cover of 5½ feet. Generally, the maximum depth shall not exceed 7 feet.
- C. **Alignment:**
 - 1. All mains shall be looped, except for short runs to serve cul-de-sacs where the distance is less than 500 feet.
 - 2. Water mains shall be constructed such that the distance service lines are extended beneath the paving of the circular turnaround on cul-de-sacs, are kept to a minimum.
 - 3. Water distribution mains will be extended to, through or across the frontage of all subdivisions and land development projects. Provisions will be made to connect water mains to serve future adjacent undeveloped land.
 - 4. Water mains will be located so the front of each property has access for a service connection.
- D. **Changes in Alignment:**
 - 1. Thrust restraints are required at all changes in alignment exceeding 10°, at all dead ends and on fire hydrants. Thrust restraints shall be constructed as shown in Figure 7.1. Wrap pipes and fittings in plastic before pouring thrust blocks.
 - 2. The maximum deflection at joints shall not exceed the pipe manufacturer's recommendations.
 - 3. Where there is considerable deflection of the water main materials required for either horizontal or vertical changes in alignment, ductile iron materials shall be used.

E. Separation from Sewers:

1. 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.
2. 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.
3. 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.
4. 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.
5. Water mains shall be separated from sewer force mains by a horizontal distance of at least 10 feet unless:
 - a. The force main is constructed of water main materials meeting a minimum pressure rating of 150 psi and the requirements of Sections 8.02 and 8.04 of these standards, and;
 - b. The water main is laid at least 4 linear feet from the sewer force main.

F. Location of Valves:

1. Four-way connections will have 3 valves. On looped systems valves will generally be on the main line. Four valves may be required in specific instances.
2. Three-way connections will have 2 valves. On looped systems valves will generally be on the main line. Three valves may be required in specific instances.
3. Maximum valve spacing will be 800 feet in residential areas or 400 feet in commercial areas. Maximum spacing of 400 feet will apply to mains bordering both residential and commercial areas.
4. A valve shall be placed 2 pipe lengths from all dead-ends to allow the extension of the pipe without shutting off the existing system. Do not tap services in the final 2 sections.
5. Auxiliary valves shall be provided for all fire hydrants.
6. Valves shall be located as close as possible to tees and crosses.
7. Valves should not be located within paving whenever possible.

G. Location of Fire Hydrants:

1. Fire hydrant spacing will be on an average distance of 400 feet. This average spacing will generally mean 1 hydrant for every block in residential, commercial and industrial areas. A fire hydrant will be required at the end of every cul-de-sac regardless of the proximity of a hydrant on the intersecting through street. A fire hydrant will be required at the end of all dead-end lines.
2. The location of fire hydrants may be modified at the request of the local jurisdiction's fire department.
3. See Figure 7.2 for typical fire hydrant installation.

H. Service Pipes:

1. Every building, including each unit of zero-lot-line residences, shall have a direct service connection to a public water main.
2. No water consumer shall construct water service pipes across lots or buildings to adjoining premises, but all service pipe shall be laid on streets, alleys or public ground to the premises to be served, and enter at the front or rear of the building nearest the main.
3. Such service pipe shall be laid in a straight line at right angles to the water

main, and connection made within 2 lines drawn parallel to the sides of the building to be served or not more than 3 feet outside of these sides.

4. Multiple stop boxes shall be permanently marked to identify the correct individual metered services.
5. See Figure 7.3 for typical water service installation.

7.06 MATERIALS

A. Ductile-Iron Pipe:

1. Thickness design shall conform to AWWA C150/A21.50-02.
2. Manufacture shall conform to AWWA C151/A21.51-02.
3. Thickness class, unless otherwise indicated or specified, shall be Class 52.
4. Cement mortar-lining shall conform to AWWA C104/A21.4-95.
5. All ductile iron pipe 8 inches in diameter and larger shall be wrapped with an 8 mil polyethylene encasement in accordance with ANSI/AWWA C105/A21.5-99 installation methods. Polyethylene encasement will not be required if tests determine the soil to be none corrosive.
6. Use single rubber-gasket push-on joints or mechanical joints conforming to ANSI/AWWA C111/A21.11-00. Furnish with all necessary hardware and gaskets.
7. Bell-and-spigot pipe joints conforming to ANSI A21.6 or ANSI A21.8.
8. For bolted/restrained mechanical joint, use Griffin Bolt-Lok restrained joint or approved equal.
9. For unbolted/restrained mechanical joint, use Griffin Snap-Lok restrained joint or approved equal.
10. Do not use drilled & tapped retainer glands.
11. Plain end of push-on pipe factory machined to a true circle and chamfered to facilitate fitting gasket.
12. All water mains shall have a 12-gauge insulated trace wire taped to the top of the pipe every 6 feet. Trace wire shall be brought to the surface at each hydrant and valve as directed.

B. Fittings:

1. All fittings shall have a pressure rating of Class 250 and conform to ANSI/AWWA C110/A21.10-98 for standard ductile-iron and gray-iron fittings

or ANSI/AWWA C153/A21.53-00 for compact ductile-iron fittings.

2. Mechanical-joint fittings shall be ductile-iron compact C153/A21.53-00 or ductile standard C110/A21.10-98. Swivel tees shall be ductile-iron standard C110/A21.10-98. Where ductile-iron is not available (i.e. offsets), cast iron standard C110.A21.10-98 shall be provided.
3. All fittings shall be Class 250, shall be bituminous coated inside and outside, and shall be furnished complete with necessary accessories including plain rubber gaskets, ductile-iron glands, bolts and nuts. Verify the gasket seats are not made irregular by improper application of the lining materials.

C. Valves & Valve Boxes:

1. Gate valves shall conform to AWWA C509-01. Use full-line size gate valves with epoxy or polymer lining. Use Clow, Mueller or Waterous valves, or an approved equal with 200 psi working pressure and gaskets rated at 250 psi. The waterway must be a full-sized waterway. Valves shall be capable of being repacked or replacing O-rings under pressure.
2. Butterfly valves shall conform to AWWA C504-00. Use Pratt, M&H or Mueller valves, or an approved equal.
3. Valves shall open left and be furnished with a 2-inch square operating nut. Use Cor-Ten steel.
4. Valve Boxes shall be a Waterous trench adapter, or approved equal range 63 inches to 83 inches. Use lids marked "water".
5. Tapping valves shall be 200 psi minimum working pressure, mechanical joint manufactured by Mueller or Clow.

D. Hydrants:

Specification standard.....AWWA Standard C502-94

Acceptable manufacturers
and model.....Waterous Pacer or Mueller SuperCenturion 200 or Clow F2500

Type of shutoff.....Compression

Type of construction.....Break flange or break bolt

Main valve opening.....5¼ inch minimum

Nozzle arrangement and size:

3 nozzle.....Two 2½-inch hose nozzles and one 4½-

inch pumper nozzle. The 4½-inch 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 inches
Depth of bury..... Distance from ground line to top of connecting pipe shall be 5½ feet
Direction of opening..... Open to left (counterclockwise)
Packing..... Conventional or O-Ring
Size and shape of operating nut..... 1½ inch, standard pentagon
Working pressure..... 150 psi
Color..... Yellow

E. 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 inches or 16 inches shall be Ford Fast stainless steel. The outlet of the tap shall not be greater than $\frac{1}{2}$ of the diameter of the pipe tapped.

F. Sleeve Type Couplings:

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 inches long, or approved equal.

G. 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 threaded rods used to restrain fittings shall be $\frac{3}{4}$ inch diameter.

7.07 BEDDING AND BACKFILL

- A. All mains 16 inches and larger shall be bedded in crushed stone to a depth of $\frac{1}{2}$ the pipe diameter. See jurisdictional construction specifications for type of crushed stone.
- B. All other pipe shall be bedded in accordance with manufacturer's recommendations.
- C. Within public right-of-way, backfill shall consist of Class A crushed stone or suitable job excavated material placed in 1-foot lifts compacted to 90% Modified Proctor Density. If crushed stone is used, the top 12 inches of backfill shall consist of suitable job excavated materials. See City's construction specifications for type of crushed stone. Flowable mortar may be used upon approval of mix design by the City Engineer. Sand backfill is not permitted.
- D. In all other areas backfill shall consist of suitable job excavated material placed in 1-foot lifts and compacted to 85% Modified Proctor Density.

7.08 PERFORMANCE AND TESTING

- A. Bacterial test for coliform organisms shall be performed by the contractor in accordance with AWWA C651-99. 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.
- B. Pressure and leakage test in accordance with AWWA C600-99.
- C. Valves shall be located and tested to verify operation.
- D. Fire hydrants shall be tested to verify operation.
- E. 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.

7.09 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 20 feet.

PART 8 - SANITARY SEWERS

8.01 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 Engineer 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 Engineer before construction.
- D. The Engineer of Record is responsible to submit "Record of Construction" drawings to the City Engineer on reproducible vellum 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 sanitary sewer facilities.

8.02 DESIGN RESOURCES AND REFERENCES

The design for sanitary facilities shall be in conformance with the Requirements and Standards of the Iowa Department of Natural Resources.

8.03 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 sanitary 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. Every building, including each unit of zero-lot-line residences, shall have a direct service connection to a public sewer main.

8.04 DESIGN FLOWS AND CAPACITY (for new construction only)

A. Peak rates will be taken at approximately 2.5 times the normal flow. Infiltration will be calculated by the addition of 200 gallons per inch pipe diameter per mile per day (200 gimd).

B. The peak wet weather flows for various land usage are as follows:

1. Single Family Dwellings
(100 gal/cap/day) x 2.5 (peak factor) +
(infiltration) = 250 gpcd + infiltration
Assume 3.5 people/home

2. Mobile Homes
(50 gal/cap/day) x 2.5 (peak factor) +
(infiltration) = 125 gpcd + infiltration
Assume 2.5 people/home

3. Multi-Family Dwellings
(75 gal/cap/day) x 2.5 (peak factor) +
(infiltration) = 187 gpcd + infiltration
Assume 1.5 people/bedroom

4. Motels and Hotels
(50 gal/cap/day) x 2.5 (peak factor) +
(infiltration) = 125 gpcd + infiltration
Assume 1.5 people/room

5. Schools, without cafeteria and/or showers
(10 gal/cap/day) x 2.5 (peak factor) +
(infiltration) = 25 gpcd + infiltration

6. Schools, with cafeteria and/or showers
(20 gal/cap/day) x 2.5 (peak factor) +
(infiltration) = 50 gpcd + infiltration

7. Office Buildings
(10 gal/cap/day) x 2.5 (peak factor) +
(infiltration) = 25 gpcd + infiltration
Assume 1 person/200 sq. ft.

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

gpcpd = gallons per capita per day

gpapd = gallons per acre per day

gimmd = gallons per inch diameter per mile per day

C. 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 gmd for infiltration.

- D. All sanitary sewers shall be a minimum of 8 inches in diameter.
- E. 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 inches and smaller and 0.75 of the pipe diameter for pipes larger than 15 inches in diameter.
- F. 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.
- G. Where velocities greater than 15 feet per second are calculated, special provisions shall be made to protect against displacement, erosion or shock.
- H. Sanitary sewers shall be sufficiently deep so as to receive sewage by gravity from basements and to prevent freezing.

8.05 SERVICE CONNECTIONS

- A. A sanitary service pipe will be provided for every platted lot or location where construction of a building is likely. A 4-inch or 6-inch sanitary service pipe will be used for single-family residential. Pipes for multi-family residential, commercial, or industrial will be sized as required.
- B. Sanitary service pipes will be extended from the main to the right-of-way line or outer utility easement line, whichever is further.
- C. No 2 sanitary services shall be constructed in the same trench. Service connections shall be separated by a minimum of 6 feet.
- D. The end of all sanitary services shall be marked with a metal post or #4 reinforcing steel at least 24 inches in length buried within 1 foot of the finished grade.
- E. 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 between 6 inches and 12 inches 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.

8.06 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 18 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 downstream from lift stations.
- B. **Ductile iron pipe** manufactured in accordance with ANSI/AWWA-C150/A21.50-02 and ANSI/AWWA-C151/A21.51-02 and meeting the following standards may be used.
1. Joints: Use push on gasketed joints.
 2. Thickness: Use Class 52 ANSI 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. **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 11432 as defined in ASTM D4396.
 2. Joints: Gaskets shall comply with requirements in ASTM F477 and F913.

Joints shall meet the requirements of ASTM D3212.

3. Pipe shall have a minimum pipe stiffness of 200 lb./inch/inch at 5% deflection.
- D. **Poly vinyl chloride (PVC)** manufactured in accordance with ASTM D3034-88 and meeting the following standards may be used for 4-inch and 6-inch services and for main line pipe 8-inch through 15-inch.
1. Joints: ASTM D3212 gasketed.
 2. All 4-inch and 6-inch services shall be SDR 23.5 or 26 PVC.
 3. SDR 35 may be used for main pipe 8-inch through 15-inch.
- 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 8.1.

TABLE 8.1

PIPE MATERIAL	SIZE	JOINT	MINIMUM STRENGTH	MINIMUM BEDDING*
<u>Sanitary Sewers</u>				
•Reinforced Concrete	18" & up	See 8.06.A..1	Class III, B wall	Type B
•PVC SDR-35	8"-15"	Gasket	SDR-35	Crushed-Stone Encasement
•PVC Truss	8"-15"	Gasket		Crushed-Stone Encasement
Ductile Iron	3" & up	Gasket, push	Class 52	Type B
<u>Sanitary Service</u>				
PVC	4" & 6"	Gasket	SDR 23.5	Crushed-Stone Encasement
DIP	4" & 6"	Gasket	Class 52	Type B

*See Figure 8.4.

- F. All sewer mains shall have a 12-gauge insulated trace wire taped to the top of the pipe every 6 feet. Trace wire shall be brought to the surface at each manhole and as directed.

8.07 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 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.
- B. Drop Connections: An external 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 2 inflow pipes, a 0.2-foot drop is required.
 3. For the same size pipe with a junction of 3 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-foot 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 a 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 21 inches in diameter and smaller, and 60 inches for pipe greater than 21 inches in diameter.
 6. Castings shall be Neenah R-1642 and Type "B" non-rocking self-sealing lid or approved equal.
- F. Standard manholes, step details, drop connections and risers are shown in Figures 8.1, 8.2 and 8.3.
 - G. 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.
 - 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. Concrete spacer rings and metal shims with grout shall be the only materials utilized to adjust manhole frame elevations. A minimum of 8 inches and a maximum of 24 inches of space rings shall be provided.

8.08 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, 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.

8.09 CREEK CROSSINGS

- A. Sanitary sewers crossing creeks shall be Class 52 D.I.P. encased in reinforced concrete or 3/8 inch thick steel carrier pipe.
- B. Rip-rap all disturbed creek banks and bottoms after construction.

8.10 BACKFILL AND BEDDING

- A. Within the right-of-way, backfill shall consist of Class A 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 Class A 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.
- B. In all other areas backfill shall consist of suitable job excavated material placed in 1-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 and shall be approved by the City Engineer.
- D. See Table 8.1 and Figure 8.4 for pipe bedding requirements.

8.11 PERFORMANCE & TESTING

- A. All sewers and manholes will be lamped and visually checked for leakage prior to acceptance.
- B. All sanitary sewers, including service pipes and manholes, will be air-tested using current ASTM standards prior to acceptance.
- C. All tests will be completed after backfill is complete.
- D. 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.

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%. 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 30 feet.
- E. Sanitary sewer mains shall be extended to, through or across the frontage of all subdivisions and land development projects. Provisions will be made to connect sanitary sewer mains to serve future adjacent undeveloped land.

8.13 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.
- D. If an area is desired to be developed which is not capable of connecting directly into the existing gravity collection system at the time of development, the developer shall install, operate and maintain a temporary lift station. This temporary lift station shall remain in operation until the gravity collection system from this development can be connected into the City's gravity system at the developer's expense.

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 cretex 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 3½ :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.

PART 10 - EROSION CONTROL

10.01 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 Engineer.
- 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.

10.02 THRESHOLDS

Residential, commercial and industrial developments larger than 1 acre in size will require an erosion-control plan.

10.03 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 inch 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.

10.04 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 11 – TRAFFIC-CONTROL SIGNALS

11.01 APPROVALS, PERMITS, AS-BUILTS AND MAINTENANCE BONDS

- A. Plans and specifications for traffic-control signals must be certified by a professional engineer registered in the State of Iowa.
- B. Plans and specifications for traffic-control signals 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 vellum or Mylar and a digital base map in an AutoCAD file or other approved electronic format.
- E. A 4-year maintenance bond covering defective materials and workmanship is required for all traffic-control signals.

11.02 DESIGN

- A. Warrants for traffic-control signals shall be as defined in the Manual on Uniform Traffic Control Devices, current edition.
- B. Design of traffic-control signals shall comply with the requirements of the "Manual on Uniform Traffic Control Devices", current edition, except as noted below.
- C. The minimum lens size shall be 12 inches.

PART 12 - ROADWAY LIGHTING

12.01 THE REQUIRED LUMEN OUTPUT AND MOUNTING HEIGHT ARE 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

12.02 THE LIGHT SOURCE SHALL BE HIGH PRESSURE SODIUM OR METAL HALIDE.

12.03 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.