# Stormwater Management Criteria

## A. Minor and Major Design Storms

The concept of minor and major design storms is related primarily to the conveyance capacity design for storm sewer and surface drainage systems. Part 2C provides a discussion of rainfall/runoff analysis and the selection of the appropriate design storm for a particular component of the stormwater management system. The concept of the unified sizing criteria is covered in Part 2A. This discussion of minor and major design storms is related to the selection of the overbank flood protection (Qp), which is one of the five components of the unified sizing criteria.

Every urban area has two separate and distinct drainage systems, whether or not they are actually planned for and designed. One is the minor system corresponding to the minor (or ordinary) storm recurring at regular intervals, generally 2 to 10 years. The other is the major system corresponding to the major or extraordinary storm, generally the 100 year storm event. A 100 year storm event was selected as the design interval for the major storm because this is typically the largest event that can be reasonably estimated from the historical rainfall data available. In addition, designing to a level above the 100 year event becomes impractical considering the relative infrequency of the event and the substantial infrastructure required to control the runoff.

Since the effects and routing of stormwater for the major storm may not be the same for the minor storm, all storm drainage plans submitted for approval should show the routing path and effects of the major storm.

1. **Minor Storm Provisions:** The minor storm drainage system should be designed to provide protection against regularly recurring damage, to reduce street and stormwater conveyance maintenance costs, to provide an orderly urban drainage system, and to provide convenience and protection to the urban residents. Storm sewer systems consisting of underground piping, natural drainage ways, and other required appurtenances should be considered as part of the minor storm drainage system.

2. **Major Storm Provisions:** The major storm drainage system should be designed to reduce the risk of substantial damage to the primary structure from storm runoff expected from the major storm. The effects of the major storm on the minor drainage system should be noted.

3. **Extreme Storm Provisions:** It is recognized that extreme storms, greater than a 100 year event, will occur; however, fully controlling storms of this magnitude is deemed economically unfeasible and impractical. While some level of damage from these extreme storm events is both likely and acceptable, their effect must be considered and provisions made to prevent widespread devastation and loss of life. This is especially true for detention basins, ponds, and other retention structures that have the potential for overtopping or catastrophic failure leading to downstream flash flooding.

## B. Design Frequencies for Conveyance Facilities

Design storms for drainage facilities are described below. A minimum cleaning velocity of 2 ft/s should be used for the 2 year storm and 3 ft/s for the design storm. When detention or overland flow provisions for storms greater than 10 years are not available, regardless of the street system, the 100 year or greater storm is required for the design to minimize impact to private properties.

1. **Intakes:** Intakes should have a minimum capacity to convey the 5 year storm under developed conditions for local streets and minor collectors during the peak flow rate. The Engineer may require 10 year frequency for intakes for major collectors, arterials, expressways, and freeways.

2. **Storm Sewers:** Storm sewers should have capacity to convey a 5 year storm under developed conditions within the pipe for local streets and minor collectors. The Engineer may require 10 year frequency for storm sewers for major collectors, arterials, expressways, and freeways. Provisions should be made for the 100 year storm, greater in critical areas, when overland flow is not allowed or available to prevent damaging private property. Storm and/or surface water conveyance easements should be provided to the Jurisdiction.

3. **Footing Drains:** For those storm sewers that will handle footing drains, the following discharge (Q) values should be used.

    a. For less than 50 houses, Q = 5.0 gpm per house.

    b. For greater than 50 houses, Q = 250 gpm plus 2.5 gpm per house for each additional house over 50.

4. **Culverts:** Culverts should have capacity to convey the following.

    a. 10 year storm without the headwater depth exceeding the diameter of the culvert.

    b. 50 year storm without the headwater depth exceeding 1 foot over the top of the culvert.

    c. 100 year storms should be conveyed through the culvert without the headwater depth exceeding 1 foot below the low point of the roadway/embankment, unless there are other, more restrictive elevations.

    d. For culverts that drain areas over 2 square miles, the Iowa DNR rules and regulations will apply.

5. **Ditches:** Ditches should have capacity to convey a 50 year storm within the ditch banks. Provisions should be made for the 100 year storm to flow overland within the flowage easement. Surface water flowage easements should be provided to the Jurisdiction for all designed drainageways. For ditches that drain areas over 2 square miles, the Iowa DNR rules and regulations will apply.

6. **Detention Basins:** Detention basins should have the capacity to retain a 100 year storm at critical duration or safely pass the 100 year discharge over an auxiliary spillway. The top of any detention embankments should be a minimum of 1 foot above the 100 year ponding elevation. Iowa DNR approval may be required when the detention basin embankment and ponding volumes meet certain thresholds for embankment height with permanent and/or temporary storage. See the Iowa Administrative Code 567, Chapter 71, 71.3 (Dams) for specific approval criteria.

## C. Street Flow Criteria

1. **Street Capacity for Minor Storms:**

   a. Pavement encroachment for minor design storm should not exceed the limitations set forth in Table 2A-3.01.

**Table 2A-3.01:** Allowable Pavement Encroachment and Depth of Flow for Minor Storm Runoff

| Street Classification | Maximum Encroachment[1] |
|---|---|
| Local | No curb overtopping. Flow may spread to crown of street. |
| Collector/Minor Arterial | No curb overtopping. Flow spread must not encroach to within 8 feet of the centerline of a two-lane street. The flow spread for more than two-lane streets must leave the equivalent of two 12 foot driving lanes clear of water; one lane in each direction. For one-way streets, a single 12 foot lane is allowed. |
| Major Arterials (4 lanes or greater) | No curb overtopping. Flow spread must not exceed 10 feet from the face of the curb of the outside lane. The flow spread for streets with more than two-lanes must leave the equivalent of two 12 foot driving lanes clear of water; one lane in each direction. For one-way streets, two 12 foot lanes are required. For special conditions, when an intake is necessary in a raised median, the flow spread should not exceed 4 feet from the face of the median curb for an inside lane. |

[1] Where no curbing exists, encroachment should not extend past property lines.

   b. The storm sewer system will commence upstream from the point where the maximum allowable encroachment occurs. When the allowable pavement encroachment has been determined, the theoretical gutter carrying capacity for a particular encroachment will be computed using the modified Manning's formula for flow in a small triangular channel as shown in Section 2B-3, Figure 2B-3.01. An "n" value of 0.016 will be used unless special considerations exist.

2. **Street Capacity for Major Storms:** The allowable depth of flow and inundated area for the major design storm should not exceed the limitations set forth in Table 2A-3.02.

**Table 2A-3.02:** Allowable Pavement Encroachment and Depth of Flow for Major (100 Year) Storm Runoff

| Street Classification | Allowable Depth and Ponded Area |
|---|---|
| Local and Collector | The ponded area should not exceed the street right-of-way and the depth of water above the street crown should not exceed 6 inches. There may be situations where other restrictions are necessary. |
| Major and Minor Arterial | A 12 foot lane is the minimum travel lane to be passable in the center of the street. |

3. **Cross-street Flow:** Cross-street flow (called cross-pan) can occur by two separate means. One is runoff that has been flowing in a gutter and then flows across the street to the opposite gutter or inlet. The second case is flow across the crown of the street when the conduit capacity beneath the street is exceeded. If the inundated area exceeds the street right-of-way, flow easements must be obtained. The maximum allowable cross-street flow depth based on the worst condition should not exceed the limitation stipulated in Table 2A-3.03.

**Table 2A-3.03:** Allowable Cross-street Flow

| Street Classification | Initial Design Storm Runoff | 100 Year Design Storm Runoff |
|---|---|---|
| Local | 6 inch depth at crown or in cross-pan | 9 inch depth at crown or in cross-pan |
| Collector | Where cross-pans are allowed, depth of flow or in cross-pan should not exceed 3 inches | 6 inch depth at crown |
| Arterial | None | 3 inch or less over crown |

## D. References

*Flood Plain Development*. Title V, Iowa Administrative Code 567. Chapter 71.3.