

**CITY OF DEWITT
CITY COUNCIL**

RESOLUTION

**A RESOLUTION BY THE CITY COUNCIL OF THE CITY OF DEWITT
ADOPTING A WATERSHED MAP FOR THE CITY AND ESTABLISHING
STORM WATER MANAGEMENT STANDARDS AS DIRECTED BY ARTICLE
XIV, CHAPTER 78 OF THE CITY CODE OF ORDINANCES**

WHEREAS, the Storm Water Management Article of the City Code requires the City Council to adopt by Resolution a Watershed Map for the City and Storm Water Management Standards which establish the minimum design standards for calculating runoff, storm water discharge release rates, and requirements for dischargers to implement on-site detention, detention, infiltration, or other methods necessary to control the rate and volume of surface water runoff discharged into the storm water drainage system; and,

WHEREAS, after research and discussion, the Storm Water Management Ordinance Working Group has developed and recommended that the City Council adopt the Watershed Map (Attachment A) and Storm Water Management Standards.

NOW, THEREFORE, BE IT RESOLVED that the City Council, based on the recommendation of the Storm Water Management Ordinance Working Group, hereby adopts the Watershed Map and Storm Water Management Standards.

Upon a motion by Councilmember Flood, seconded by Councilmember Rundborg, the above and forgoing Resolution was unanimously approved by the City Council at their meeting held on January 13, 2003. Councilmember Lancaster was excused.

Attachment B

City Of DeWitt, Michigan Storm Water Management Standards

Adopted by the City Council on January 13, 2003 in accordance with Article XIV, Chapter 78 of the City of DeWitt Code of Ordinances.

The City of DeWitt requires that both the volume and rate of storm water runoff resulting from development be controlled. Specific requirements and the methodology to be followed for each requirement are described below. Sample calculations for a hypothetical site entitled “**Sample Site Acres**” are also provided for the applicant’s benefit.

Volume Control

The increase in storm water runoff volume resulting from development from the 10-year, 24-hour storm shall be controlled in an approved manner such that it does not leave the site boundaries by surface water discharge.

Volume = (Post-development runoff volume) – (Pre-development runoff volume)

The volume of storage required shall be calculated by using the methodology contained in Table 4. The calculated volume is the minimum amount that must be controlled. The applicant may, subject to City approval, control additional volume.

Pre-development runoff volume shall be calculated as follows:

$$\text{Volume}_{\text{pre}} \text{ (acre-feet)} = C_{\text{pre}} * \text{rainfall (inches)} / 12 \text{ (inches/foot)} * \text{site area (acres)}$$

C_{pre} = Pre-development runoff coefficient calculated by using the values provided in Table 1, calculated as a weighted average of all surface conditions as per Table 2.

rainfall = 3.43 inches (equal to 10-year, 24-hour total rainfall as per MDEQ)

Post-development runoff volume shall be calculated as follows:

$$\text{Volume}_{\text{post}} \text{ (acre-feet)} = C_{\text{post}} * \text{rainfall (inches)} / 12 \text{ (inches/foot)} * \text{site area (acres)}$$

C_{post} = Post-development runoff coefficient calculated by using the values provided in Table 1, calculated as a weighted average of all surface conditions as per Table 3.

rainfall = 3.43 inches (equal to 10-year, 24-hour total rainfall as per MDEQ)

Any one or combination of the following methods may be used to meet this requirement:

- a. Infiltration (e.g. basin or trench)
- b. Retention (e.g. non-regulated wetland or permanent pool)
- c. Evapo-transpiration
- d. Bio-retention
- e. Other proposed BMP(s) or means subject to City approval

The applicant is required to provide evidence that soil and other site conditions are suitable for the proposed method. All storm water facilities intended to meet this requirement shall be located within City rights-of-way, parcel outlots, or other common areas accessible by the City by easement or other methods.

Rate Control

The storm water runoff not otherwise controlled in accordance with the volume control requirements above shall be released off-site at a controlled rate. Runoff from storm events up to, and including, the 100-year, 24-hour storm shall be released at or below the rate of 0.15 cubic feet per second (cfs) per acre of site area.

Maximum allowable release rate = 0.15 (cfs/acre) * site area (acres)

The volume of storage required to meet the design release rate shall be calculated by using the methodology contained in Table 5. Note that the storm water runoff volume utilized in this calculation excludes that which is subject to volume control as calculated in Table 4 above.

Any one or combination of the following methods may be used to meet this requirement:

- a. Detention (e.g. basin or pond)
- b. Subsurface storage (e.g. restricted storm drainage pipe system)
- c. Other proposed BMP(s) or means subject to City approval

City of DeWitt, Michigan
Storm Water Management Standards
Table 1 - Runoff Coefficients

| Surface Condition | Runoff Coefficient |
|---------------------------------------|--------------------|
| Water Surfaces | |
| Wetlands - Marsh - Swamp | |
| Roofs | |
| Asphalt and Concrete Pavement | |
| Gravel | |
| Brick | |
| Agricultural - Cultivated Fields | |
| Meadow - Pasture | |
| Dense Weeds and Brush | |
| Dense Woods | |
| Lawns, Parks, Playgrounds (<4% slope) | |
| Hydrologic Soil Group A | |
| Hydrologic Soil Group B | |
| Hydrologic Soil Group C | |
| Hydrologic Soil Group D | |
| Lawns, Parks, Playgrounds (≥4% slope) | |
| Hydrologic Soil Group A | |
| Hydrologic Soil Group B | |
| Hydrologic Soil Group C | |
| Hydrologic Soil Group D | |

**City of DeWitt, Michigan
 Storm Water Management Standards
 Table 2 - Pre-Development Runoff Coefficient**

| Surface Condition | "C" | Area (acres) | C*Area |
|---|-----|--------------|--------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Total | | | |
| Average (Weighted) Runoff Coefficient "C" | | | |

Procedure:

1. Surface Condition - Identify the condition from the list included in Table 1.
2. "C" - Note the runoff coefficient "C" from Table 1 that matches the noted surface condition.
3. Area (acres) - Note the size, in acres, of the portion of the site containing the noted surface condition.
4. C*Area - Multiply the runoff coefficient "C" by its corresponding area.
5. Total - Add the individual surface condition areas and C*Area values.
6. Average (Weighted) Runoff Coefficient "C" - Divide the sum of C*Area values by the total site area.

City of DeWitt, Michigan
Storm Water Management Standards
Table 3 - Post-Development Runoff Coefficient

| Surface Condition | "C" | Area (acres) | C*Area |
|-------------------|-----|--------------|--------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Total | | | |
| Average "C" | | | |

Procedure:

1. Surface Condition - Identify the condition from the list included in Table 1.
2. "C" - Note the runoff coefficient "C" from Table 1 that matches the noted surface condition.
3. Area (acres) - Note the size, in acres, of the portion of the site containing the noted surface condition.
4. C*Area - Multiply the runoff coefficient "C" by its corresponding area.
5. Total - Add the individual surface condition areas and C*Area values.
6. Average (Weighted) Runoff Coefficient "C" - Divide the sum of C*Area values by the total site area.

City of DeWitt, Michigan
Storm Water Management Standards
Table 4 - Volume Control Storage Calculation

Site Information

Site Location: _____

Site Area: _____ (acres)

Pre-development runoff coefficient ("C") _____

Post-development runoff coefficient ("C"): _____

Required Storage for Volume Control: _____ (acre-feet)
 (Copy value from below)

Volume Control Storage Calculation

| Volume _{post} (C _{post})*(3.43/12)*(site area) (acre-feet) | Volume _{pre} (C _{pre})*(3.43/12)*(site area) (acre-feet) | Required Volume (acre-feet) |
|---|---|-----------------------------------|
| | | |

Procedure:

1. Volume_{post} - Multiply post-development runoff coefficient C_{post} calculated in Table 3 by 3.43 inches, divide by 12 to convert to feet, and multiply by the site area in acres.
2. Volume_{pre} - Multiply pre-development runoff coefficient C_{pre} calculated in Table 2 by 3.43 inches, divide by 12 to convert to feet, and multiply by the site area in acres.
3. Required Volume - Subtract Volume_{pre} from Volume_{post} to determine the required volume to be controlled on-site.

City of DeWitt, Michigan
Storm Water Management Standards
Table 5 - Rate Control Storage Calculation

Site Information

Site Location: _____

Site Area: _____ (acres)

Pre-development runoff coefficient ("C") _____

Post-development runoff coefficient ("C"): _____

Maximum allowable release rate: _____ (cfs)
 (Site Area * 0.15)

Required Storage for Rate Control: _____ (acre-feet)
 (Copy peak value from below)

Rate Control Storage Calculation

| Storm Duration (hours) | Rainfall Amount (inches) | 100% Runoff (acre-feet) | Runoff Coefficient ("C") | Effective Runoff _{post} (acre-feet) | Adjusted Runoff (acre-feet) | Controlled Outflow (acre-feet) | Required Storage (acre-feet) |
|------------------------|--------------------------|-------------------------|--------------------------|--|-----------------------------|--------------------------------|------------------------------|
| 0.17 | 1.19 | | | | | | |
| 0.33 | 1.65 | | | | | | |
| 0.50 | 1.90 | | | | | | |
| 0.67 | 2.13 | | | | | | |
| 1 | 2.30 | | | | | | |
| 2 | 2.80 | | | | | | |
| 3 | 3.00 | | | | | | |
| 4 | 3.20 | | | | | | |
| 5 | 3.25 | | | | | | |
| 6 | 3.30 | | | | | | |
| 7 | 3.36 | | | | | | |
| 8 | 3.44 | | | | | | |
| 9 | 3.51 | | | | | | |
| 10 | 3.60 | | | | | | |
| 12 | 3.72 | | | | | | |
| 18 | 3.96 | | | | | | |
| 24 | 4.32 | | | | | | |

Procedure:

1. 100% Runoff - Multiply site area in acres times rainfall amount in inches, divide by 12 to convert to acre-feet.
2. Runoff coefficient "C" - Note the post-development runoff coefficient developed in Table 3.
3. Effective Runoff_{post} - Multiply the value calculated for 100% runoff by the post-development runoff coefficient "C_{post}".
4. Adjusted Runoff - The total amount of post-development runoff volume less that stored elsewhere for volume control. equation is (Effective Runoff_{post}) - (Effective Runoff_{post})*(Required Storage for Volume Control from Table 4)/(Total Effective Runoff_{post})
5. Controlled Outflow - The volume of runoff that has been discharged off-site through the rate control structure; multiply the allowable discharge rate (cfs) times the storm duration (hours) times 3,600 seconds per hour divided by 43,560 to convert to acre-feet.
6. Required Storage - The difference between adjusted runoff and controlled outflow requiring storage.

City of DeWitt, Michigan
Storm Water Management Standards
Table 1 - Runoff Coefficients

| Surface Condition | Runoff Coefficient |
|---------------------------------------|--------------------|
| Water Surfaces | 1.00 |
| Wetlands - Marsh - Swamp | 0.15 |
| Roofs | 0.90 |
| Asphalt and Concrete Pavement | 0.98 |
| Gravel | 0.85 |
| Brick | 0.85 |
| Agricultural - Cultivated Fields | 0.40 |
| Meadow - Pasture | 0.25 |
| Dense Weeds and Brush | 0.20 |
| Dense Woods | 0.15 |
| Lawns, Parks, Playgrounds (<4% slope) | |
| Hydrologic Soil Group A | 0.20 |
| Hydrologic Soil Group B | 0.30 |
| Hydrologic Soil Group C | 0.35 |
| Hydrologic Soil Group D | 0.50 |
| Lawns, Parks, Playgrounds (>4% slope) | |
| Hydrologic Soil Group A | 0.25 |
| Hydrologic Soil Group B | 0.35 |
| Hydrologic Soil Group C | 0.40 |
| Hydrologic Soil Group D | 0.55 |

**City of DeWitt, Michigan
 Storm Water Management Standards
 Table 2 - Pre-Development Runoff Coefficient**

Site Location: _____

Sample Site Acres

| Surface Condition | "C" | Area (acres) | C*Area |
|---|-------------|--------------|-------------|
| | | | |
| Meadow | 0.25 | 36.00 | 9.00 |
| Wetlands/swamp | 0.20 | 4.00 | 0.80 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Total | | 40.00 | 9.80 |
| Average (Weighted) Runoff Coefficient "C" | | | 0.25 |

- Procedure:
1. Surface Condition - Identify the condition from the list included in Table 1.
 2. "C" - Note the runoff coefficient "C" from Table 1 that matches the noted surface condition.
 3. Area (acres) - Note the size, in acres, of the portion of the site containing the noted surface condition.
 4. C*Area - Multiply the runoff coefficient "C" by its corresponding area.
 5. Total - Add the individual surface condition areas and C*Area values.
 6. Average (Weighted) Runoff Coefficient "C" - Divide the sum of C*Area values by the total site area.

City of DeWitt, Michigan
Storm Water Management Standards
Table 3 - Post-Development Runoff Coefficient

Site Location:

Sample Site Acres

| Surface Condition | "C" | Area (acres) | C*Area |
|--|-------------|--------------|--------------|
| Wetlands/swamp | 0.20 | 4.00 | 0.80 |
| Open space (undisturbed meadow) | 0.25 | 1.00 | 0.25 |
| Grass right-of-way ("B" soil lawn >4% slope) | 0.30 | 1.45 | 0.44 |
| Grass right-of-way ("B" soil lawn >4% slope) | 0.35 | 1.45 | 0.51 |
| Roadway (asphalt pavement) | 0.98 | 2.10 | 2.06 |
| Roofs | 0.90 | 2.10 | 1.89 |
| Driveways/sidewalk (concrete) | 0.98 | 1.60 | 1.57 |
| Lawns ("B" soil <4% slope) | 0.30 | 13.15 | 3.95 |
| Lawns ("B" soil >4% slope) | 0.35 | 13.15 | 4.60 |
| | | | |
| | | | |
| | | | |
| | | | |
| Total | | 40.00 | 16.06 |
| Average "C" | | | 0.40 |

Procedure:

1. Surface Condition - Identify the condition from the list included in Table 1.
2. "C" - Note the runoff coefficient "C" from Table 1 that matches the noted surface condition.
3. Area (acres) - Note the size, in acres, of the portion of the site containing the noted surface condition.
4. C*Area - Multiply the runoff coefficient "C" by its corresponding area.
5. Total - Add the individual surface condition areas and C*Area values.
6. Average (Weighted) Runoff Coefficient "C" - Divide the sum of C*Area values by the total site area.

City of DeWitt, Michigan
Storm Water Management Standards
Table 4 - Volume Control Storage Calculation

Site Information

| | | |
|---|--------------------------|-------------|
| Site Location: | Sample Site Acres | |
| Site Area: | 40.00 | (acres) |
| Pre-development runoff coefficient ("C") | 0.25 | |
| Post-development runoff coefficient ("C"): | 0.40 | |
| Required Storage for Volume Control: (Copy value from below) | 1.79 | (acre-feet) |

Volume Control Storage Calculation

| Volume _{post} (C _{post})*(3.43/12)*(site area) (acre-feet) | Volume _{pre} (C _{pre})*(3.43/12)*(site area) (acre-feet) | Required Volume (acre-feet) |
|---|---|-----------------------------------|
| 4.59 | 2.80 | 1.79 |

Procedure:

1. Volume_{post} - Multiply post-development runoff coefficient C_{post} calculated in Table 3 by 3.43 inches, divide by 12 to convert to feet, and multiply by the site area in acres.
2. Volume_{pre} - Multiply pre-development runoff coefficient C_{pre} calculated in Table 2 by 3.43 inches, divide by 12 to convert to feet, and multiply by the site area in acres.
3. Required Volume - Subtract Volume_{pre} from Volume_{post} to determine the required volume to be controlled on-site.

City of DeWitt, Michigan
Storm Water Management Standards
Table 5 - Rate Control Storage Calculation

Site Information

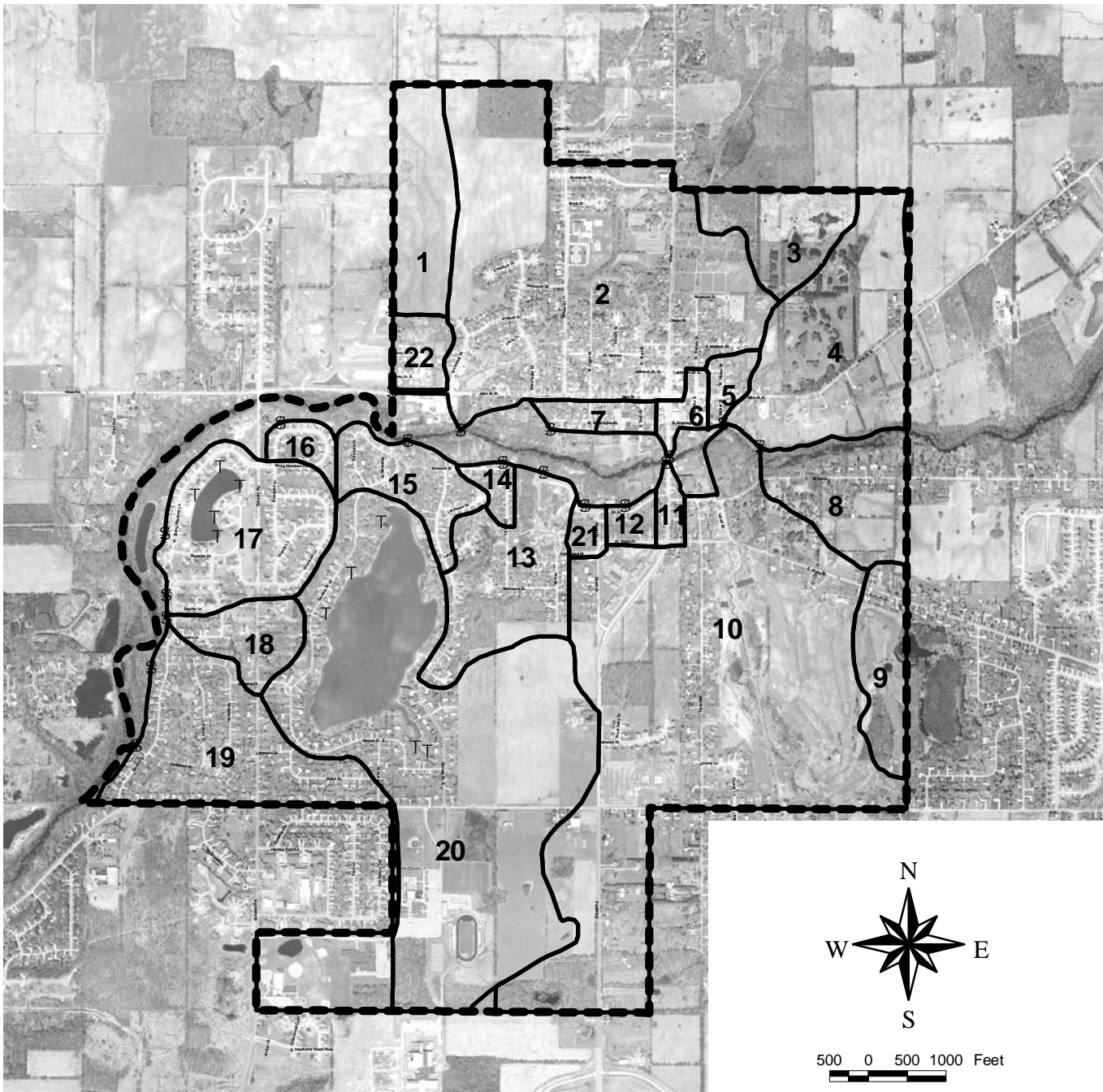
| | | |
|---|--------------------------|-------------|
| Site Location: | Sample Site Acres | |
| Site Area: | 40.00 | (acres) |
| Pre-development runoff coefficient ("C") | 0.25 | |
| Post-development runoff coefficient ("C"): | 0.40 | |
| Maximum allowable release rate: (Site Area * 0.15) | 6.00 | (cfs) |
| Required Storage: (Copy peak value from below) | 1.64 | (acre-feet) |

Rate Control Storage Calculation

| Storm Duration (hours) | Rainfall Amount (inches) | 100% Runoff (acre-feet) | Runoff Coefficient ("C") | Effective Runoff _{post} (acre-feet) | Adjusted Runoff (acre-feet) | Controlled Outflow (acre-feet) | Required Storage (acre-feet) |
|------------------------|--------------------------|-------------------------|--------------------------|--|-----------------------------|--------------------------------|------------------------------|
| 0.17 | 1.19 | 3.97 | 0.40 | 1.59 | 1.10 | 0.08 | 1.02 |
| 0.33 | 1.65 | 5.50 | 0.40 | 2.21 | 1.52 | 0.16 | 1.36 |
| 0.50 | 1.90 | 6.33 | 0.40 | 2.54 | 1.76 | 0.25 | 1.51 |
| 0.67 | 2.13 | 7.10 | 0.40 | 2.85 | 1.97 | 0.33 | 1.64 |
| 1 | 2.30 | 7.67 | 0.40 | 3.08 | 2.13 | 0.50 | 1.63 |
| 2 | 2.80 | 9.33 | 0.40 | 3.75 | 2.59 | 0.99 | 1.60 |
| 3 | 3.00 | 10.00 | 0.40 | 4.01 | 2.77 | 1.49 | 1.28 |
| 4 | 3.20 | 10.67 | 0.40 | 4.28 | 2.96 | 1.98 | 0.97 |
| 5 | 3.25 | 10.83 | 0.40 | 4.35 | 3.00 | 2.48 | 0.52 |
| 6 | 3.30 | 11.00 | 0.40 | 4.42 | 3.05 | 2.98 | 0.07 |
| 7 | 3.36 | 11.20 | 0.40 | 4.50 | 3.10 | 3.47 | -0.37 |
| 8 | 3.44 | 11.47 | 0.40 | 4.60 | 3.18 | 3.97 | -0.79 |
| 9 | 3.51 | 11.70 | 0.40 | 4.70 | 3.24 | 4.46 | -1.22 |
| 10 | 3.60 | 12.00 | 0.40 | 4.82 | 3.33 | 4.96 | -1.63 |
| 12 | 3.72 | 12.40 | 0.40 | 4.98 | 3.44 | 5.95 | -2.51 |
| 18 | 3.96 | 13.20 | 0.40 | 5.30 | 3.66 | 8.93 | -5.27 |
| 24 | 4.32 | 14.40 | 0.40 | 5.78 | 3.99 | 11.90 | -7.91 |

Procedure:

- 100% Runoff - Multiply site area in acres times rainfall amount in inches, divide by 12 to convert to acre-feet.
- Runoff coefficient "C" - Note the post-development runoff coefficient developed in Table 3.
- Effective Runoff_{post} - Multiply the value calculated for 100% runoff by the post-development runoff coefficient "C_{post}".
- Adjusted Runoff - The total amount of post-development runoff volume less that stored elsewhere for volume control. equation is (Effective Runoff_{post}) - (Effective Runoff_{post})*(Required Storage for Volume Control from Table 4)/(Total Effective Runoff_{post})
- Controlled Outflow - The volume of runoff that has been discharged off-site through the rate control structure; multiply the allowable discharge rate (cfs) times the storm duration (hours) times 3,600 seconds per hour divided by 43,560 to convert to acre-feet.
- Required Storage - The difference between adjusted runoff and controlled outflow requiring storage.



LEGEND

- § River Outfall
- T Lake Outfall
- City Limits
- Watersheds

WATERSHED AREAS

| | | |
|---------------|---|-----------------|
| Watershed #1 | - | 2,188,700 sqft |
| Watershed #2 | - | 12,225,180 sqft |
| Watershed #3 | - | 1,795,600 sqft |
| Watershed #4 | - | 4,898,179 sqft |
| Watershed #5 | - | 427,563 sqft |
| Watershed #6 | - | 420,379 sqft |
| Watershed #7 | - | 595,281 sqft |
| Watershed #8 | - | 2,393,848 sqft |
| Watershed #9 | - | 1,550,092 sqft |
| Watershed #10 | - | 17,299,840 sqft |
| Watershed #11 | - | 333,024 sqft |
| Watershed #12 | - | 361,738 sqft |
| Watershed #13 | - | 3,224,370 sqft |
| Watershed #14 | - | 350,585 sqft |
| Watershed #15 | - | 1,598,971 sqft |
| Watershed #16 | - | 497,672 sqft |
| Watershed #17 | - | 3,832,223 sqft |
| Watershed #18 | - | 1,245,683 sqft |
| Watershed #19 | - | 6,037,000 sqft |
| Watershed #20 | - | 14,994,820 sqft |
| Watershed #21 | - | 313,123 sqft |
| Watershed #22 | - | 686,792 sqft |

*Adopted by the City Council
on 1/13/03
in accordance with
Article XIV, Chapter 78 of the
City of DeWitt Code of Ordinances*

This map has been developed based upon information provided by:
The Clinton County, Michigan GIS Department

**CITY OF DEWITT STORM WATER
MANAGEMENT PLAN**

**ATTACHMENT A
WATERSHED MAP**

