Section 5 – Storm Water Management

SECTION 5 – STORM WATER MANAGEMENT

I. GENERAL

5.1 DEFINITIONS

A. Detention Basin - A storm water facility whose purpose is to detain storm water from a specific drainage area prior to discharging the runoff downstream. For the purpose of these requirements a detention basin will be considered to be "dry" prior to a rain event.

B. Retention Basin - A storm water facility whose purpose is to detain storm water from a specific drainage area, prior to discharging the runoff downstream. For the purpose of these requirements a retention basin will be considered to contain water at all times.

C. Best Management Practices (BMPs) - schedules of activities, prohibitions of practices, maintenance procedures, and other management practices (both structural and non-structural) to prevent or reduce the pollution of surface waters of the state. BMPs also include treatment requirements, operating procedures, and practices to control plant and/or construction site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

D. Design Year - The frequency with which a storm of a specific intensity and duration will be experienced over an infinite period of time. Therefore, it signifies the probability of a storm with a specific intensity occurring within one year.

Probability = 1/Design Year

Examples: 1/25 year = 4% probability of occurring every year

Typical design year events are the 1, 2, 5, 10, 25, 50 and 100 year storms.

E. Major Flood Path - A system that conveys and temporarily stores runoff from rarer storms, such as the 25-through 100-year events. The major flood path is utilized whenever the capacity of the street gutters, storm sewers and inlets is exceeded. The major flood path components consist of the following:

- Streets
- Swales
- Detention basins - multipurpose
- Manmade channels - open and closed
- Natural Creeks, streams, wetlands and rivers

F. One Hundred (100) Year Floodplain or One Hundred (100) Year Flood Route – A major flood path as shown on the most recent 100 year floodplain delineation as may be approved by Council at any given time. Such 100 year floodplain delineation, as approved by Council at any given time, is adopted by reference and made a part of this section.

5.2 MAJOR FLOOD PATH

The intent of planning, designing, constructing, and maintaining a major flood path is to ensure that the storm water runoff, which exceeds the capacity of the storm sewer and other conveyance systems, shall have a route to follow which will not cause a loss of property or life.

The combination of the major flood path and sewer/ditch system shall have the capacity to carry runoff from a 100-year frequency storm. Where the street is designated as the major drainage way, the depth of flow shall not exceed 8 inches at the face of the curb. When the major drainage way is located outside a street right-of-way, utility and floodway easements shall be provided and a grading plan is to be submitted with detailed elevations showing the flood being contained in this area.

Minimum garage, first floor and minimum window opening and/or window well elevations along all one hundred (100) year flood routes are to be set by the design engineer. These elevations are to be a minimum of one (1) foot above the one hundred (100) year water elevation. These elevations are to be clearly labeled on the plans and the subdivision plat. In addition, all lots along the major flood path shall have the Building "Envelope" established by the Engineer.

Since streets may be used as the major flood path, the major system must be taken into account in the initial design of the development. It shall be designed in such a manner as to direct the storm water into the detention or retention area. Calculations indicating the capacity of the Major Flood Path and the excess storm water runoff from the sewer/ditch system shall be provided with the final design.

II. DETENTION/RETENTION FACILITIES

5.3 DESIGN CRITERIA

The peak discharge shall be controlled by reducing the 25-year post-developed peak discharge to the 2-year pre-developed peak discharge over the same area. The City may require the use of a 1-year pre-developed storm.

For developments which satisfy the criteria established in Section 5.8 the peak rates of runoff and volumes shall be controlled using the "Critical Storm Method". This method is used to determine the design frequencies utilized in the design of the detention/retention structures for the development.

"Critical Storm Method";

1. The peak rate of runoff from a Critical Storm (as determined below) and all more frequent storms occurring on the development area shall not exceed the peak rate of runoff from a 2-year frequency storm over the same area under pre-development conditions.
2. Storms of less frequent occurrence than the Critical Storm, up to the 100-year storm, shall have peak runoff rates no greater than peak runoff rates from equivalent size storms under pre-development conditions.

   The Critical Storm for a specific development area is determined as follows:

   A) Determine by appropriate hydrologic methods the total volume of runoff from a 2-year frequency, 24-hour storm occurring over the development area before and after development.

   B) From the volumes determined in (2-A), determine the percentage increase in volume of runoff due to development, and using this percentage, select the 24 hour Critical Storm from the following table:

% Increase in Volume of Runoff		"Critical Storm" Discharge Limitation
(at least)	(but less than)	Year
0	20	2
20	50	5
50	100	10
100	250	25
250	500	50
500	or more	100

For detention/retention structures located "off-line", storage volume does not have to be provided for runoff from off-site upstream areas. Upstream runoff shall be conveyed through or around the site in accordance with the current runoff conditions and shall not cause an increase in the probability of upstream or downstream flooding. Detention/retention structures located "in-line" (receive runoff from off-site areas), shall be designed as regional detention/retention facilities. Post-construction hydrographs shall be developed for the

entire watershed assuming full development of upstream areas according to current zoning requirements. The post-construction hydrographs shall be routed through the basin and shall not exceed the allowable release rates according to the applicable design criteria. The design criteria for a regional basin shall be as described herein under Critical Storm method by considering the percent increase in runoff from the entire watershed assuming full development of upstream areas, unless otherwise approved by the City.

The requirements of this Section for runoff rates and volumes shall be satisfied at each location where runoff leaves the development area.

For areas less than 5 acres, the modified rational method shall be used to develop the inflow hydrographs. Storm intensities shall be taken from the Intensity-Duration-Frequency (IDF) relationships given in the NOAA (National Oceanic and Atmospheric Administration) Atlas 14, Volume 2, most recent version. The IDF values from this atlas are currently available on the NOAA's on-line Precipitation Frequency Data Server found at http://hdsc.nws.noaa.gov/hdsc/pfds/orb/oh_pfds.html. For areas between 5 and 20 acres, the modified rational and technical release 55 (TR-55) methods are acceptable. Any development over 20 acres shall use the TR-55 method or USGS Regression Equation as approved by the Engineering Department. Hydrographs shall be calculated using rainfall depths from the NOAA Atlas 14, Volume 2 which are also currently available on the NOAA's on-line Precipitation Frequency Data Server. A latitude of 41.24° N and longitude of 81.44° W shall be used for location identification.

Routing calculations and their corresponding inflow and outflow hydrographs shall be provided for the 2, 5, 10, 25, 50 and 100 year storms along with the pre-developed hydrographs which establish the allowable release rates. The results shall be tabulated and included in the drainage calculations. The table shall include allowable outflow, peak inflow, peak outflow, maximum water surface elevation and other additional information as required.

5.4 DOWNSTREAM ANALYSIS

The purpose of the storm water management design criteria is to protect downstream properties from flood increases due to upstream development. Due to peak flow timing and runoff volume effects, some structural controls fail to reduce downstream peak flows to pre-developed levels. Therefore, a downstream analysis is required to ensure no adverse impacts to downstream properties. The downstream analysis shall consist of a hydrologic model of the larger watershed which includes the area draining to the site and shall

include key detention structures existing in the watershed. The watershed shall be divided into an appropriate number of sub-areas with homogeneous hydrologic characteristics, and peak flows shall be determined in the downstream channel or system by combining the hydrographs generated for the applicable sub-areas. The analysis must begin at a point downstream of the site where the watershed is at least 10 times larger than the site area. The analysis must show that the post-developed 100-year peak flow does not exceed the pre-developed 100-year peak flow in the downstream channel or system at all critical points in the downstream system including stream confluences, major storm sewer outfalls, and any other locations which experience a significant change in flow as directed by the City. A drainage map of the watershed with the critical locations identified shall be submitted to the City for review prior to proceeding with the downstream analysis.

The downstream analysis will be performed by the City of Hudson in areas where the City has previously developed a watershed model. The design engineer may be requested to submit additional information or calculations for the site being developed to update the City's watershed model. The City currently has a watershed model for the Mud Brook watershed which is delineated on the City's watershed map available at http://www.hudson.oh.us/departments/ISGIS/maps/MajorWatersheds_11x17.pdf. For developments outside the Mud Brook watershed, the design engineer shall contact the City to determine if models for the other watersheds are available before proceeding with the downstream analysis.

5.5 DETENTION BASIN

A. Allowable Side Slope - The grading of the detention basin shall be such that it reflects the surrounding topography. The embankment slopes for the detention basin should be 4' horizontal to 1' vertical (4:1) preferred or at a maximum of 3' horizontal to 1' vertical (3:1).

B. Outlet/Overflow Structure - The outlet structure shall be a multi-staged structure, consisting of a catch basin (2' x 2' or larger) with a primary outlet (typically an orifice) at the invert. The primary outlet shall be designed to pass the Critical Storm or 25-year storm and shall be a minimum of 4" in diameter. All orifices less than or equal to 6" shall have screening to prevent clogging. The catch basin grate/windows shall be set at an elevation equal to 0.5' (minimum) above the Critical Storm or 25-year storm pond elevation and/or shall be designed to pass the 100-year storm including off-site runoff without utilizing the emergency spillway. See figure 5.5.1. Access to the entire outlet structure shall be provided and shall follow current OSHA Standards. If the water quality outlet is less than 4" in diameter, the normal water surface elevation of the basin

shall be assumed to be the bottom of the primary outlet for purposes of the routing analysis unless otherwise approved by the City.

C. Emergency Spillway - The Emergency Spillway elevation shall be set at an elevation equal to 0.5' (minimum) above the 100-year water surface elevation and at least 0.5 feet below the top of the basin embankment. See figure 5.5.1. The design of the spillway shall be as follows:

- Primary outlet orifice diameter less than or equal to 15" – The spillway shall be designed to pass the 100-year storm assuming the primary outlet is completely clogged. The spillway depth shall be determined such that the water surface from this calculation is below the top of the embankment. The spillway width shall be no more than 10 feet unless otherwise approved by the City.
- Primary outlet orifice diameter greater than 15" - The spillway width shall be 10 feet and set at an elevation 1 foot below the top of the embankment.

Permanent erosion control measures at the spillway may be required by the City based on potential erosion at the site.

D. Low Flow Channel - Detention Structures shall be graded to drain to the outlet structure. The minimum grade in the pond shall be 4%. Paved gutters shall not be used as the low flow channel.

E. Landscaping on Basin Embankments – Trees and brush placed on or near basin embankments shall comply with the Ohio Department of Natural Resources Division of Water fact sheet Dam Safety: Trees and Brush (Fact Sheet 94-28 or latest version). Landscaping (including trees) shall not be placed on or near basin embankments unless approved by the City. When permitted by the City, all landscaping (including trees) shall conform to Section 9 – Landscaping and Street Trees.

5.6 RETENTION BASIN

A. Allowable Side Slope - The grading of the Retention basin shall be such that it reflects the surrounding topography. The embankment slopes for the Retention basin shall be 4' horizontal to 1' vertical (4:1) leading to the pond. All ponds shall have a 10 foot wide bench around the entire pond. The bench shall be set at an elevation 1 foot below the normal water surface elevation of the pond.

B. Outlet/Overflow Structure - The outlet structure shall be designed following the guidelines in Section 5.5.B except for the following:

- The primary structure used to pass the critical storm may be other than an orifice.
- The invert of the primary structure shall be set at an elevation such that the depth of the pond shall be between 3 feet and 5 feet as approved by the City.
- Anti-seep collars shall be provided for all outlet pipes.

C. Emergency Spillway - Refer to Section 5.5.C.

D. Miscellaneous - Retention basins shall have a minimum of 10 acres draining to the pond or as approved by the City.

Soil borings may be required by the City to verify the suitability of the soils at the site. If soils are highly permeable a 6" clay liner may be required.

E. Landscaping on Basin Embankments - Refer to Section 5.5.E.

5.7 STORM WATER QUALITY

Transportation projects which replace or rehabilitate an existing facility shall provide Best Management Practices (BMPs) for storm water quality that meet the requirements of the Ohio Department of Transportation, Location & Design Manual, Volume II, latest edition. Storm water quality calculations for transportation projects shall be reviewed by the City.

Subdivision development and site improvements shall provide BMPs that meet the requirements of the Ohio Environmental Protection Agency Construction General Permit, latest edition. The design of these BMPs are to follow the guidelines shown in "Rainwater and Land Development, Ohio's Standards for Storm Water Management, Land Development and Urban Stream Protection". Copies are available from the ODNR, Division of Soil and Water Conservation. The storm water quality calculations shall be submitted along with the plans to the Summit County Soil & Water Conservation District for review and approval. The plant materials used in the BMPs shall be coordinated with the City.

5.8 ALTERNATIVE DETENTION FACILITIES

In certain applications, alternative detention facilities, may be permitted on a case by case basis. Alternative detention facilities consist of the following:

- Infiltration Basin
- Underground Detention (Commercial/Industrial Location Only)

All requests for alternative detention facilities shall be submitted to the City with appropriate design standards. After review of the request, if approval is granted, soil borings shall be required for an infiltration basin.

5.9 DETENTION FACILITIES ON SMALL SITES

Smaller developments (typically facilities that have a drainage area of 0.5 acres or less) may have difficulty providing the storm water management required, as described above. Maintenance problems arise when the outlet for common detention structures becomes small (less than 4" exclusive of water quality outlets). Where the required outlet structure is less than 4" in diameter the following options shall be considered to decrease the peak rate of runoff:

- The Critical Storm Method shall be used to establish the design criteria for the detention/retention facility.
- Provide detention in parking areas utilizing catch basins with the orifice exiting from the bottom of the basins to the sewer.
- Provide a reduction in peak flows with the use of Best Management practices (BMP). These include the use of grass swales and filter strips. To utilize these BMP's the proposed parking areas and roof drains should discharge into these structures which will detain the peak flow by increasing the flow time across the site. Information on these structures is contained in "CONTROLLING URBAN RUNOFF: A Practical Manual for Planning and Designing Urban BMP's", which can be obtained by contacting the Metropolitan Washington Council of Governments.
- Provide detention using a drywell or other infiltration device approved by the City of Hudson with an overflow.

III. DETENTION BASIN EASEMENTS

(Refer to Paragraph 6.6)

IV. EROSION CONTROL

5.10 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

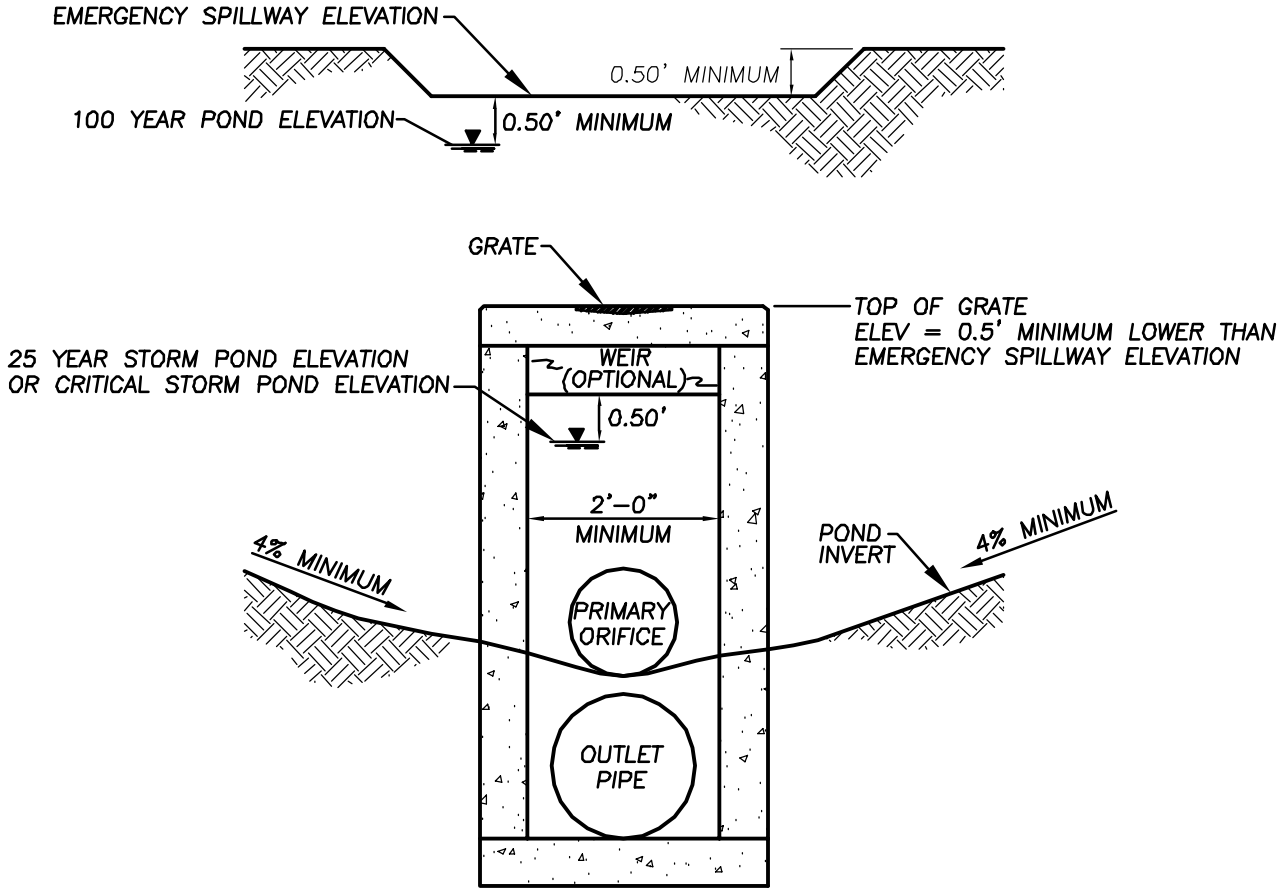
A. Requirements - Erosion and Sediment Control Practices shall be used on all construction sites, including residential building sites. Separate erosion control plans using an appropriate scale shall be submitted for all site plans. Construction details shall also be included.

B. Design Methods - Design Methods used shall follow the standards set forth in "Rainwater and Land Development, Ohio's Standards for Storm Water Management, Land Development and Urban Stream Protection". Copies are available from the ODNR, Division of Soil and Water Conservation

C. Summit Soil & Water Conservation District Review - The Summit Soil & Water Conservation District shall review and approve all erosion control plans for subdivisions, commercial/industrial sites and any other construction site as required by the City.

D. Notice of Intent Requirements - For all applicable sites, a Notice of Intent (NOI) is required to be filed with the OEPA, prior to the start of construction per the Ohio Water Pollution Control Act - 33 U.S.C. 1251.

E. Inspection Requirements - Construction, including clearing and grubbing, shall not begin until the appropriate erosion control measures are installed and a zoning certificate has been issued. After installation of the erosion control measures the City shall inspect these measures. Upon approval of the erosion control measures the Contractor may resume construction.



DETENTION POND / RETENTION POND OUTLET AND EMERGENCY SPILLWAY RELATIONSHIP

N.T.S.

SEE DISCLAIMER STATEMENT ON THE TITLE PAGE OF THESE ENGINEERING STANDARDS

OUTLET.DWG 11-28-01

FIG 5.5.1