

# **Storm Water Management Standards**

Village of Hammond

Prepared for:

Village of Hammond  
St. Croix County, Wisconsin  
January 2020

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## **General**

### **Background**

The Storm Water Management Standards provides design standards (quantity and quality) for storm water systems in the Village. Implementation of these standards will 1) create consistent hydrologic, hydraulic and water quality analysis methods, and 2) provide design standards for storm water systems in the Village.

The purpose of these standards is to minimize the impact of existing and future development on the Village's natural resources. These standards are a supplement to the Village of Hammond Storm Water Management Plan, and are implemented through the Village of Hammond Construction Site Erosion Control Ordinance and Post-Construction Storm Water Runoff Control Ordinance.

### **Applicability**

These standards promote consistent practices and safeguard the interests of the Village of Hammond by ensuring that all storm water management improvements are designed and constructed in conformance with sound engineering principles and accepted standards. This information has been prepared to assist developers, builders and engineers in the development of storm water management systems in the Village of Hammond.

### **Jurisdiction**

The review and approval of storm water management plans by the Village of Hammond for certain improvements is not exclusive. Other public agencies may have review jurisdiction, including but not limited to Wisconsin Department of Natural Resources, St. Croix County, Wisconsin Department of Transportation, Department of Industry, Labor, and Human Relations, and Army Corps of Engineers. This document does not cover the requirements of other public agencies having review jurisdiction.

## **Storm Water Quantity Standards**

### **Hydrologic Design Method**

The U.S.D.A. Natural Resources Conservation Services (NRCS) method shall be the basis for all hydrologic studies. The Design Storms (OS) will be based on a 2-year, 10-year, 25-year, 50-year and 100-year return period, 24-hour duration, Type II distribution with average soil moisture conditions (AMC-2).

Hydrograph Method shall be the preferred methodology for design, and only pre-approved methods and models will be accepted. The hydrograph methods and models currently approved are the USDA-NRCS, TR20 & TR55, and HydroCAD. The Rational Method shall be acceptable for minor systems, if approved by the Village Engineer. Other hydrologic methods or models must be submitted to the Village Engineer for approval.

## Rainfall Data

The rainfall data used for hydrologic analysis is listed in Table 1 below:

Table 1: Rainfall Data

Rainfall Event (Years)	Rainfall (Inches)
2-Year	2.92
10-Year	4.40
25-Year	5.28
50-Year	6.02
100-Year	6.88

This data is based on the Midwestern Climate Center Bulletin 71 Rainfall Frequency Atlas of the Midwest, (Huff, Angel).

## Storm Water Conveyance System Design

The storm water conveyance systems (storm sewer, inlets, ditches, etc.) shall be analyzed using a 10-year, 25-year and 100-year frequency rainfall. Full pipe flow analysis shall be used unless special conditions can be demonstrated to support the consideration of pressure flow. See the Village of Hammond Street & Utility Design Standards for additional design (layout, spacing, depth, etc.) standards.

Storm sewers and inlets shall have the capacity to discharge the 10-year developed condition storm, with ponding only allowed at inlets located at low spots. Storm sewers and inlets shall have the capacity to discharge the 25-year developed condition storm with less than 0.3 feet of ponding at the flow-line around any inlet.

Inlets shall be located to prevent runoff from a 10-year storm from flowing through intersections of public roadways. Valley gutters shall not be allowed to cross the street unless approved in writing by the Village Engineer.

The flow path of the 100-year event storm runoff should be evaluated to ensure that runoff will remain within the right-of-way or easement, and that no structural damage will occur.

Culvert crossings or storm systems in County or State right-of-way may have a design frequency that differs from the Village's standard. Each agency/unit of government shall be contacted to determine the appropriate design frequency.

## **Detention and Storage System Design**

The storm water detention and storage design shall be analyzed using the 2, 10, 25, 50 and 100-year frequency rainfall events.

The storm water pond should detain and store additional storm water runoff from development such that the peak discharge from the design storms under the proposed condition will not exceed the peak discharge from the design storms under pre-developed conditions. Pond location and geometric requirements are discussed in the Storm Water Quality Standards section of the Storm Water Management Standards.

Pond inlets shall be placed above the normal water level. Detention pond inlet pipes shall have a slope of not less than 0.5%, unless approved by the Village Engineer. When pond inlets consist of storm sewer pipe, they shall have concrete end walls and rip rap. Open channel pond inlets must incorporate rip rap protection.

Pond outlets shall be designed with appropriate energy dissipation to reduce discharge velocities to acceptable levels based on the type and condition of the downstream conveyance.

Pond outlet pipes shall be evaluated to determine if anti-seep collars are needed. If required, anti-seepage collars shall be installed so as to increase the creep distance or seepage line along conduit by 15 percent. Maximum spacing should be approximately 14 times the minimum projection of the collar measured perpendicular to the pipe. Anti-seepage collars shall be used on culverts under public streets if both of the following conditions exist:

- A water or ponding structures with a pool depth of 2 feet and a duration of two days.
- A design head of 10 feet or more.

## **Emergency Overflow Design**

Detention ponds and other storm water storage features shall be designed with overland emergency overflow routes to eliminate the possibility of flooding of private property due to landlocked areas.

Emergency overflow shall be designed to discharge the 100-year, 24-hour storm event with one foot of freeboard.

There shall be no discharge through the emergency overflow spillway during storm runoff events smaller than the 100-year, 24-hour storm, unless the emergency overflow spillway is part of the primary outlet.

In the event a landlocked storage area cannot be avoided, additional storage shall be provided to safely store the storm water runoff from the 100-year, 10-day rainfall event (9.92 inches) under saturated or frozen soil conditions (CN = 100).

# Storm Water Quality Standards

## Water Quality Design Method

The storm water model SLAMM may be used to evaluate the effectiveness of storm water treatment and infiltration practices. Other models may be used with the approval of the Village Engineer.

Storm Water management structures should be designed to provide storm water flow rate control (quantity) and treatment (quality) as specified in these standards. The requirements may be met through implementation of any one device; however, a "treatment train" approach is the preferred method of storm water management.

## Parking Lots/Streets

In reconstructing existing parking lots, parking density will have to be reduced to allow for storm water treatment practices. Parking lot and street reconstruction projects typically have limited space restrictions, and only allow for a few BMPs. At a minimum, filtering of storm water and infiltration of small amounts of runoff should be planned. Proposed parking lot and street projects should implement as many of the following strategies as possible:

- Reduce the amount of impervious area in the form of parking lot islands and peninsulas with pervious depressed areas. These areas should be designed to provide filtering of storm water by means of grassed filter strips.
- Rain gardens receive the filtered runoff and provide detention and infiltration. The rain gardens also provide an aesthetic landscape for the parking lots. Infiltration trenches could be constructed within the rain gardens and filter strip areas, and provide overflow drainage to storm sewer systems.
- Curbed openings should be used to allow runoff to be distributed over grassed filter strip areas. These areas could also implement rain gardens and infiltration areas. The rain gardens must be sized to handle the drainage areas and incoming flows, which are typically small sub-basins. An overall drainage and retention plan should be designed for the parking lots, with a designed outlet. Curb openings can be provided at low spots of street grades to allow storm water to flow through filter strips. Erosion protection and level spreading may be required.
- Parking areas providing large amounts of storm water detention could utilize tree planting around the detention basins. The shading reduces the temperatures of the storm water, minimizing thermal impacts to receiving waters.
- Infiltration trenches and basins also provide thermal benefits of treated storm water. Storm water infiltration requires filtering pretreatment, suitable soils and groundwater separation, and is typically limited to small drainage areas.

- Oil and grease filters should be used in parking areas prone to oil and grease contamination. Catch basin sumps can also be used to capture sediment. These types of structural BMPs require regular maintenance to perform effectively.
- Underground storm water detention systems provide storm water detention in chambers located underground. Parking areas can be located above the storage chambers, maximizing the use of space for parking and storm water detention. The chamber systems are designed with an isolator row that captures sediment, and can be cleaned out routinely. Storm water pretreatment is required if the system is designed to allow for infiltration. This may include oil and grease filters.

### **Building Roof**

Proposed building renovation and construction projects should implement as many of the following strategies as possible:

- Utilize storm water reuse for toilet flushing. This requires storage tanks that collect roof water runoff. This serves as a reduction of storm water, based on the quantity of water needed for toilet flushing.
- Disconnect roof drains from storm sewer system. This should be utilized in new construction and renovation when possible. Building roof runoff can be directed to rain gardens to provide detention and infiltration. Rain gardens can be located at building downspout locations. Rain gardens should be sized to handle the quantity of roof runoff. In place of rain gardens, grassed swales could convey runoff to bioretention areas.
- Bioretention areas provide detention and infiltration of building roof runoff. Bioretention of building roof runoff requires suitable soils and groundwater separation, and is typically limited to small drainage areas.
- Building roofs generating large amounts of storm water detention could utilize tree planting around the detention basins. The shading reduces the temperatures of the storm water, minimizing thermal impacts to receiving waters.
- Infiltration trenches and basins also provide thermal benefits of treated storm water. Storm water infiltration requires suitable soils and groundwater separation, and is typically limited to small drainage areas.

### **Open Space**

Open space land use within the Village consists primarily of parks, and other large lawn type areas. The opportunity to create new open space within the existing development areas may arise with removal of abandoned structures or other improvements. These areas could provide additional open space that was previously impervious area. New development must incorporate open space design. Proposed open space design for renovation and new construction projects should implement as many of the following strategies as possible:

- Provide filter strips and sediment collection areas prior to storm sewer inlets. This can be accomplished by allowing storm water to pass through grassed filter strips prior to storm sewer catch basins or inlets. Check structures such as rock filter beds could be placed upstream of inlets receiving sediment laden runoff. These areas require regular maintenance.
- Rain gardens could be placed around low-lying areas near storm sewer inlets. These provide detention and infiltration of low flows, and require filtering of storm water. Rain gardens also serve as a decorative landscape feature.
- Grassed swales could be used to convey surface runoff for short distances to storm sewer collection inlets. Native grasses and landscape features can be added to the swales, to deter foot traffic in these areas.
- Bioretention areas provide detention and infiltration of surface runoff. Storm water infiltration requires filtering pretreatment, suitable soils and groundwater separation, and is typically limited to small drainage areas. These should be placed in areas near a dedicated storm sewer outlet or drainage feature, and away from areas dedicated for recreational use.
- Infiltration trenches and basins provide thermal benefits of treated storm water. Storm water infiltration requires filtering pretreatment, suitable soils and groundwater separation, and is typically limited to small drainage areas.

## **Infiltration Pond Design**

### **General**

Infiltration volume and pretreatment requirements shall follow NR 151 and WDNR Technical Standards (example-Technical Standard 1002, 1003, 1004). Infiltration design must also incorporate the following:

- Pretreatment practices should effectively remove 80% of TSS from storm water runoff entering infiltration devices.
- Forebays shall be provided at all storm water detention pond inlets, as a pretreatment BMP. A submerged berm (18 inches below the normal water level) shall separate the forebay from the main pond. The forebay shall be designed to remove 60% of the TSS.
- Infiltration pond design must provide the ability to completely drain the pond.
- The design infiltration rate shall be one-half of the average of the field measured infiltration rates. The maximum allowable design infiltration rate shall be 5 inches per hour.
- A minimum of three double ring infiltrometer tests (ASTM D3385) are required to determine the field measured infiltration rate.

## Location

Storm water ponds shall be located adjacent to a Village street. Ponds shall not be located behind lots, without direct street access.

## Geometrics

The minimum length to width ratio of the pond should be greater than or equal to 3:1. Prevent short-circuiting of storm water flows by maximizing the distance between inlet and outlet points.

Detention ponds shall have a minimum of 4 feet and a maximum of 6 feet of standing water (dead storage) below the invert of the outlet structure.

The maximum slope above the normal water level shall be 4:1 (H:V). A safety shelf must be constructed with a 10:1 (H:V) slope extending 8 feet from shore. The maximum slope below the safety shelf shall be 3:1 (H:V).

Provide a vehicle access lane/bench around the berm to the storm water pond.

- Vehicle access lane(s) at least 12 feet wide shall be provided, at a slope less than 15 percent from a public road to the pond, to accommodate maintenance vehicles.
- The vehicle access lane(s) shall be stabilized to withstand heavy equipment.
- Access shall encircle entire pond area above the 100-year high water elevation for the pond. The access around the pond shall provide access and turning radius to allow travel of a small dump truck. The slope shall not exceed 15 percent.
- If this access bench is further than 20 feet horizontally from the normal water level, a supplemental access bench shall be provided within 4 feet horizontally from the normal water elevation.

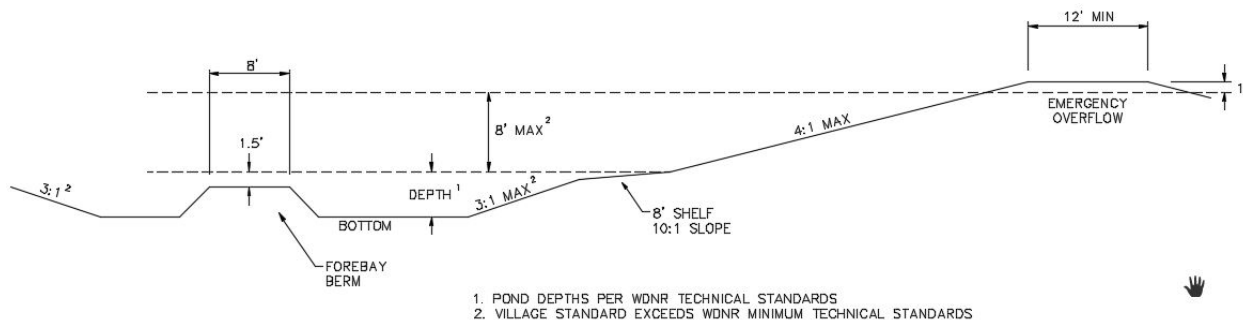


Figure 1 – Pond Dimensions

## **Grassed Swales**

The construction of grassed swales to collect and convey runoff from streets, parking lots, and yards is recommended where site layouts permit. This provides a hybrid method of curb and gutter collection leading to grassed swales as a method of pretreatment, and pipe collection as conveyance. Uncut, native grasses are more efficient at removing pollutants, but are not required. Non-invasive grass is acceptable. Beyond removing pollutants, grassed swales also encourage infiltration. The grassed slopes draining to the swales act as vegetated filters and typically provide the required pretreatment. Swale pollutant removal must be modeled with SLAMM.

All rear and side yard swales shall be centered on property lines, where practical. Swales used for storm water treatment shall have:

- A minimum bottom width of 4 ft.
- A maximum side slope of 3:1.
- A maximum longitudinal slope of 5%.

## **Bioretention Areas and Rain Gardens**

The WDNR Technical Specifications Document for "Bioretention for Infiltration" (1004) shall be used as a guideline. Design infiltration rates shall be determined as specified in these standards. For purposes of these standards, the term bioretention area will include all types of rain gardens. There are three main components to a bioretention area: vegetation, underdrain pipe and soil, and overflow structure. These components can be combined in different arrangements to suit the needs of a site. These three components are described below.

### **Vegetation**

Vegetation should be chosen to be aesthetically pleasing to the site. The vegetation can include grasses, flowering plants, shrubs, and trees. Trees, however, should not be placed at the inflow areas and should not affect flow through the bioretention area. Native plants should be used and deep root structures are preferred. Native plants are typically more esthetically pleasing, and deep root structures are often better at removing subsurface water. Native plants will be more efficient at removing pollutants and can be chosen to be more salt resistant. Two to three inches of hardwood mulch or chips should be placed on the surface of the bioretention area.

### **Underdrain Pipe and Soil**

The underdrain pipe and soil shall be designed to provide a draw down time of less than 24-hours after a runoff event. An underdrain pipe may be eliminated for small runoff areas with sandy soils, with appropriate infiltration test results. For the soil types in the Village of Hammond, an underdrain will almost always be required for larger runoff areas. This underdrain can discharge directly to a downstream storm sewer or other storm water conveyance structure or directly to the surface water. Placing one to four feet of a free draining material, such as washed stone, below the underdrain will promote infiltration. Additional design requirements for underdrain pipe include cleanout access and winter drawdown. Using a slightly larger underdrain pipe will help the bioretention area stay dry prior to freezing and help prevent flooding during the spring runoff.

## **Overflow Structures**

Bioretention areas are only intended to capture and treat the 1 and 2-year runoff events. Overflow structures must be designed to allow a ponding depth of no more than 12 inches. The two most common overflow devices are catch basin inlets and weirs. Weirs are commonly used when the bioretention area is designed to overflow to another bioretention area or to a surface conveyance system. Catch basin inlets are commonly used when the bioretention area is designed to overflow to a storm sewer system.

## **Oil and Grease Filters**

Oil and grease filters or separators are required in areas that are prone to petroleum contamination. Oil and grease filters are required in spill prone paved areas draining to storm inlets at gas stations, mechanic shops, and vehicle maintenance areas. Oil and grease filters should reduce petroleum in runoff, to the extent that no petroleum sheen is visible in the discharge waters. Maintenance plans must be developed for projects utilizing oil and grease filters.

## **Infiltration Trench and Basins**

Infiltration volume and pretreatment requirements shall follow NR 151 and WDNR Technical Standards (example - Technical Standard 1002, 1003, 1004). Infiltration design must also incorporate the following:

- Pretreatment practices should effectively remove 80% of TSS from storm water runoff entering infiltration devices.
- Infiltration trenches with underdrain pipes must include cleanout access and winter drawdown. A slightly larger underdrain pipe will help the infiltration trench stay dry prior to freezing and help prevent flooding during the spring runoff.
- The design infiltration rate shall be one-half of the average of the field measured infiltration rates. The maximum allowable design infiltration rate shall be 5 inches per hour.
- A minimum of three double ring infiltrometer tests (ASTM 03385) are required to determine the field measured infiltration rate.

## **Minimum Building Elevations**

### **Minimum Building Opening Elevation Requirement**

The minimum building opening elevation for structures adjacent to water bodies shall be the greatest of the following:

- An elevation 2 feet above the 100-year design storm elevation.
- An elevation based on the location, capacity and elevation of the emergency overflow. The minimum building opening elevation shall be at least 1 foot above the overflow elevation.

Plans for ponding areas shall include the minimum building opening elevation for each adjacent lot. This information must be included on both the plat and the construction documents.

### **Construction**

Storm water ponds may function as a sediment basin during construction. Any accumulated sediment must be removed before final pond restoration. Protect the entrance of storm water ponds from further sedimentation, after the restoration of storm water ponds is completed.

During construction protect infiltration areas from construction traffic by placing a fence around these areas.

Except where more stringent methods are specified in this manual, erosion control devices shall be installed using the methods presented in the WDNR Storm Water Management Technical Standards for Construction Site Erosion & Sediment Control.

Post-construction BMPs that depend on infiltration (bio-retention areas, swales, infiltration basins, etc) shall not be used to treat construction site runoff.

## **Erosion Control**

### **General**

WDNR's Storm Water Technical Standards for Construction Site Erosion & Sediment Control shall be followed. All methods presented in the WDNR's Storm Water Technical Standards for Construction Site Erosion & Sediment Control have been approved by the Village Engineer.

The disturbed surfaces shall be minimized to the smallest area practical at any point during construction.

## **Erosion Control Materials and Sequence**

Materials used for erosion control practices shall be located on the WDOT erosion control Product Acceptability List (PAL).

Wherever possible, erosion control elements shall be installed prior to ground disturbing activities.

All Disturbed areas and exposed soils shall be stabilized and/or restored within 14 day of suspension of grading activities.

## **Sediment Near Site Entrances**

BMP's shall be installed and maintained to minimize the tracking of sediment onto public streets and highways.

BMP's may include, but are not limited to, stone tracking pads, or washing stations

The developer or contractor shall daily remove from public streets all sediment generated by the construction site.

## **Inspection and Maintenance**

The developer or contractor shall maintain all erosion control systems in a functional condition until the site is stabilized.

The developer or contractor shall inspect erosion control weekly and immediately after each rainfall event greater than 0.5 inches. All necessary maintenance shall be performed within 48 hours.

## **Erosion Control Along Drainage Easements**

Drainage easements shall be seeded, mulched and protected with erosion control mat. Install silt fence along all sides of drainage easements, accurately following the easement locations. The silt fence must be left in place after site restoration to function as a construction limit for future private construction activities. The silt fence at the upstream and downstream ends of the drainage easements may be removed after complete site restoration, per Village Engineer approval.

## **Erosion Control Failure**

If eroded soil enters a property adjacent to the construction site, the developer or contractor shall immediately develop a clean-up and restoration plan and obtain right of entry from the adjoining property owner. The clean-up and restoration plan should be initiated within 48 hours of obtaining the adjacent property owner's permission.

If eroded soil enters a public street, highway, sidewalk, or trail, the developer or contractor shall remove the soil and sweep the surface within four hours. If eroded soil is not removed, Village can begin the notification process, and remove eroded soil at the building permit holder's expense. See the Village Storm Water Ordinance.

The developer or contractor shall provide traffic control and flagging required to protect the traveling public from eroded soil and equipment during and prior to the clean-up operation.

### **Silt Fence**

See the WDNR Technical Specifications Document for "Silt Fence" (1056). The following notes are supplemental to the WDNR technical specifications:

Silt fence shall be provided to keep untreated runoff on site.

### **Erosion Mat**

See the WDNR Technical Specifications Document for "Channel Erosion Mat" (1053). The following notes are supplemental to the WDNR technical specifications:

Disturbed slopes at or above a 3.5:1 (H:V) slope shall be seeded and protected with the appropriate type and class of erosion mat or shall be sodded and staked.

Drainage swales and ditches shall be stabilized by:

- Sodding and staking, or properly design hydroseed and appropriate type and class of erosion mat.
- Silt fence placed parallel with ditch along easement line.

### **Temporary Seeding**

See the WDNR Technical Specifications Document for "Seeding for Construction Site Erosion Control" (1059). The following notes are supplemental to the WDNR technical specifications:

Temporary seeding shall be placed on all exposed soil, which has not been brought to final grade and which will not be disturbed within the upcoming 30 days. This requirement includes all fill and topsoil stockpiles, which will not be moved within the upcoming 30 days.

If exposed soils, which have not been brought to final grade, will be undisturbed for more than one year, both temporary and permanent seeding shall be placed.

### **Storm Water Easements and Outlots**

All storm water conveyance and ponding shall be confined to public right-of-way or drainage easements. All drainage easements shall have 1-foot of freeboard from the 100-year high water elevation.

Drainage easements shall be provided wherever storm water runoff from two or more lots is received. Wherever possible, drainage easements should be centered on property/lot lines. Drainage easement shall be provided at emergency overland overflow locations.

Minimum Drainage easement widths are 15' for drainage channels, and 20' for piped systems.