

Northeast Wisconsin Stormwater Consortium (NEWSC)

Reference Guide for the

Post Construction Stormwater Management Ordinance



North East Wisconsin Stormwater Consortium

Prepared by:

NEWSC Building and Development Committee

For the NEWSC Membership

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EXECUTIVE SUMMARY

The NEWSC Post Construction Stormwater Management Ordinance Reference Guide (Reference Guide) has been created to act as a companion to the NEWSC Post-Construction Stormwater Management Model Ordinance (Ordinance). The Ordinance cites the Reference Guide as the resource for details that were omitted from the model Ordinance due to the potential for variations in each municipality's permitting process and level of expertise in regard to the Ordinance. Items in the Reference Guide can be changed without the public hearing process as the changes are typically administrative and/or technical and do not affect the Ordinance's intent and requirements. The Reference Guide is organized similar to the Post-Construction Stormwater Management Ordinance for ease of relating the comments in the Reference Guide to the appropriate sections in the ordinance.

S.01 AUTHORITY

S.02 FINDINGS OF FACT

S.03 PURPOSE AND INTENT

- (1) PURPOSE
- (2) INTENT

Post Construction Stormwater Management Ordinance							
Requirements ¹							
Site	Sediment (TSS)	Peak Discharge	Infiltration		Protective Area	Fueling & Vehicle Maintenance Areas	
			Residential	Non-Residential			
< 20,000 ft ² Impervious Surface ²	No Numeric Standard	No Numeric Standard	No Numeric Standard	No Numeric Standard	Width Varies	No Visible Petroleum Sheen	
≥ 20,000 ft ² to 1ac Impervious Surface ³	Set by Municipality	1/2/10/100 cfs	No Numeric Standard	No Numeric Standard	Width Varies	No Visible Petroleum Sheen	
≥ 1ac Impervious Surface	New Development	80%	1/2/10/100 cfs	90% of pre-development infiltration volume	60% of pre-development infiltration volume	Width Varies	No Visible Petroleum Sheen
	Redevelopment	40%	1/2/10/100 cfs	Exempt	Exempt	Potentially Exempt	No Visible Petroleum Sheen
	Routine Maintenance Area	None, unless discharging into a BMP	None, unless discharging into a BMP	Exempt	Exempt	Potentially Exempt	No Visible Petroleum Sheen
Agricultural Production Areas	Set by Municipality. Delete if no municipal standards or requirements.						
TMDL Phosphorous Removal	Phosphorous removal targets are watershed specific and may vary across the municipality.						
Transportation Facilities ⁴	<ul style="list-style-type: none"> • Carry runoff through a grass swale a minimum of 200 feet long • Velocity in grass swale < 1.5ft/s for the 2-yr, 24-hour storm peak discharge 						

¹ Summary of Section S.07 Performance Standards of the Post-Construction Stormwater Management Zoning Ordinance. See Ordinance and this Reference Guide for specific requirements, exemptions and prohibitions.

² The impervious surface areas created after the adoption date of the Ordinance are cumulative. For example, if a site first adds 18,000 ft² of parking and then adds a 2,001 ft² building the following year, the site is held to the >20,000 ft² requirements at that time.

³ The impervious surface areas created after the adoption date of the Ordinance are cumulative. For example, if a site first adds 18,000 ft² of parking and then adds a 2,001 ft² building the following year, the site is held to the >20,000 ft² requirements at that time.

⁴ Provides alternative criteria for transportation facilities with grass swale drainage systems. The alternative criteria may be used by the applicant to satisfy Section S.07 Performance Standards. The alternative criteria may not be used for transportation facilities that are part of a larger common plan of development.

S.04 APPLICABILITY AND JURISDICTION

- (1) APPLICABILITY
- (2) JURISDICTION
- (3) EXCLUSIONS

The Wisconsin Department of Transportation (WisDOT) has entered into a memorandum of understanding with the Wisconsin Department of Natural Resources that satisfies s281.33(2), Wis. Stats., such that, activities directed and supervised by WisDOT are exempt from this ordinance.

Activities directed and supervised by the local municipality are covered by this ordinance

S.05 DEFINITIONS, ABBREVIATIONS, ACRONYMS, COMPUTER MODELS, ETC

DEFINITIONS

As used in this guide, the following terms will have the meanings indicated:

“Biofiltration System” means a bioretention system which does not qualify for any infiltration credit pursuant to S.07(3)(c) of the Post Construction Stormwater Management Ordinance.

“Structural Height” means the difference in elevation, in feet, between the point of lowest elevation of the top of the embankment before overtopping and the lowest elevation of the downstream toe of embankment.

“Surveyed Drawing(s)” means a drawing, certified by a Professional Engineer shall be submitted upon completion of construction of all best management practices. As part of the record drawings, the Professional Engineer may need to verify BMP performance using computer modeling. Refer to record drawing checklist for requirements. For the purposes of this document, the use of terms such as As-Built Drawings or Record Drawings are interchangeable with the term “Surveyed Drawing(s)”.

“Vegetative Treatment Area” or “VTA” means an area of permanent vegetation used for agricultural wastewater treatment.

ACRONYMS

The following abbreviations shall have the designated meanings:

“BMP(s)” means Best Management Practices.

“CMP” means Corrugated Metal Pipe.

“EIA” means Effective Infiltration Area.

“MEP” means Maximum Extent Practicable.

“NR” means, when prefaced prior to a number, references Wisconsin Administrative Code for the Department of Natural Resources (NR) and the number references a specific chapter of said Administrative Code.

“NRCS” means Natural Resource Conservation Service.

“NAV88” means the 1988 North American Vertical Datum.

“PE” means Polyethylene plastic.

“PVC” means Polyvinyl Chloride plastic.

“RCN” means Runoff Curve Number.

“TMDL” means Total Maximum Daily Load.

“T_c” means Time of Concentration.

“TSS” means Total Suspended Solids.

“USDA” means the United States Department of Agriculture.

“WDNR” means the Wisconsin Department of Natural Resources.

“WisDOT” means the Wisconsin Department of Transportation.

COMPUTER MODELING

The following models will be used to evaluate compliance with the performance standards:

Hydraflow: is an application for urban hydrosystems engineering. It is designed primarily for hydrologic analysis of both simple and complex drainage basins. It can be used as a basic tool for determining runoff from various historical and synthetic storms, and in planning or modeling flood control measures, such as detention ponds.

P8: called the P8 Urban Catchment Model is a program for Predicting Polluting Particle Passage through Pits, Puddles and Ponds and can be used for selecting and sizing BMPs, surface water quantity routing, small urban area assessments, watershed scale land use planning, site planning and evaluation for compliance, simplified watershed scale pollutant generation and transport simulations and routing through control structures.

WinSLAMM: Source Loading and Management Model used to better understand the relationships between sources of urban runoff pollutants and runoff quality. WinSLAMM can be used for water quality planning, site design, water loss determinations, predicting runoff yields and checking structure effectiveness.

Any other modeling software approved by the administering authority.

S.06 TECHNICAL STANDARDS

Below is a list of Technical Standards and Guidance Documents that shall be used to satisfy Performance Standards contained in the ordinance. Technical Standards specify the minimum criteria for a best management practice (BMP). Guidance Documents contain recommendations and additional “how to” guidance. Performance Standards take precedence over Technical Standards and Technical Standards take precedence over Guidance Documents.

(1) TECHNICAL STANDARDS

The following are applicable Wisconsin Department of Natural Resources (WDNR) Conservation Practice Standards or Technical Standards:

- 1001: Wet Detention Pond
- 1002: Site Evaluation for Stormwater Infiltration
- 1003: Infiltration Basin
- 1004: Bioretention for Infiltration
- 1005: Vegetated Swale
- 1006: Method for Predicting the Efficiency of Proprietary Storm Water Sedimentation Devices
- 1007: Infiltration Trench

- 1008: Permeable Pavement
- 1009: Rain Gardens
- 1100: Interim Turf Nutrient Management

These standards may be found on the WDNR Website.

The following are applicable Natural Resources Conservation Service (NRCS) Conservation Practice Standards:

- 313: Waste Storage Facility
- 350: Sediment Basin
- 378: Pond
- 607: Field Ditch (Swale)
- 635: Vegetated Treatment Area

These standards may be found in the NRCS Field Office Technical Guide

(2) LOCAL MODIFICATIONS TO TECHNICAL STANDARDS:

The following are local requirements which are intended to supplement, clarify or supersede WDNR Technical Standards.

● **1001 – Wet Detention Pond**

- Pond Watershed
 - Wet ponds are not recommended for small watersheds (<15 acres in clay soil). A wet pond located in a small watershed may develop stagnation problems and become a public nuisance. Public acceptance of stormwater BMPs is important to the success of a local stormwater program. Dry ponds, biofiltration, proprietary devices and other BMPs are recommended for small watersheds.
- Soil Borings
 - Soil borings or test pits are required at the location of proposed wet detention ponds. Information obtained from the soil borings and test pits shall be documented in the site stormwater management report following the requirements found in the Infiltration and Groundwater Evaluation Checklist and Technical Standard 1001 (Wet Detention Pond). Include any information known about karst features or direct conduits to groundwater.
- 100-Year Floodplain
 - Wet and dry detention ponds shall not be located in a 100-year floodway or 100-year flood storage area unless a hydrologic and hydraulic study is conducted in accordance with NR 116. Easements will be required if the flood study indicates the 100-year floodway or flood storage area is impacted by the pond or its embankment. Ponds shall not impede 100-year flood conveyance along navigable streams and non-navigable channels.
- Permanent Pool
 - Pool Shape: a minimum length to width ratio of 3:1 is required between the principal inlet and principal outlet. The applicant may request a waiver if site characteristics create a hardship. Redevelopment and pond retrofit projects

may be eligible for a waiver. Typically, new development is not eligible for a waiver.

- Peak Flow Control
 - Do not use table 1 in Technical Standard 1001 (Wet Detention Pond). Use the maximum pre-development RCNs contained in the Post-Construction Stormwater Management Ordinance.
 - It is recommended that the developer and designer contact the local municipality to discuss peak discharge requirements for the site early in the design process. The local municipality may have adopted alternative peak discharge requirements for the site which are different than the Post-Construction Stormwater Management Ordinance. Review the flood prone area map. At a minimum, the peak discharge requirements contained in NR 151 shall be met.
- Inflows
 - Pipe inlets shall be protected from soil washouts due to seepage along the pipe's granular bedding and backfill. Rip-rap or other protection shall be placed around the entire pipe perimeter.
 - Other inflow points shall be protected from scour and erosion.
- Principal Outlet
 - All flows shall pass through the principal outlet during the 1-year, 2-year and 10-year, 24-hour design storms. The principal outlet shall consist of one or more flow control structures and discharge pipes.
 - Pipes: Generally concrete, PVC or CMP are the preferred pipe materials. Corrugated PE will tend to jack-up due to frost heave and flotation. The minimum recommended pipe diameter is 12-inches.
 - Orifices: Orifices smaller than 4-inches are not recommended due to the potential for clogging. Consider using a 6-inch perforated drain pipe and restrictor plate [refer to Section V.B.8 of Technical Standard 1004 (Bioretention for Infiltration) for guidance]. The total opening area of all perforation holes combined shall be sufficient to allow the drain pipe to discharge at full capacity, as would occur if there were no orifice restriction. Backfilling the drain pipe with 1-inch washed stone provides protection from clogging.
 - Trash racks or other equivalent litter control devices are required for all outlet openings that control the 1-year and 2-year, 24-hour design storm. The maximum bar spacing shall be less than 2-inches and less than $\frac{1}{2}$ the smallest opening dimension, whichever is more restrictive. The minimum surface area for the trash rack shall be 5 to 10 times the outlet's cross sectional area to prevent clogging. Trash racks keep litter and debris in the pond and prevent it from discharging into streams, rivers and lakes.
 - Trash Racks are also required for other outlet openings that have a width, height or diameter less than 12-inches. The maximum bar spacing shall be less than $\frac{1}{2}$ the smallest opening dimension. The minimum surface area for the trash rack shall be at 5 to 10 times the outlet's cross sectional area to prevent clogging.

- Reverse –sloped pipes and other underwater outlets may impact a wet pond’s TSS removal efficiency. Outlets that draw water from below the permanent pool’s surface elevation reduce the effective surface area and depth of the permanent pool. If reverse-sloped pipes and other underwater outlets are used, special consideration is required for WinSLAMM & P8 modeling to ensure accurate water quality results. Also, underwater outlets may freeze during winter.
- Flap Gates and Check Valves
 - Flap gates or check valves are required if the 1-year, 2-year or 10-year, 24-hour design storm flows backward through the principal outlet. Backwater from a down slope conveyance system may impact a pond’s water quality and/or flood control performance.
 - Flap gates or check valves are not required if the permanent pool’s water surface elevation is higher than the 10-year water elevation at the pond outlet (i.e. tailwater)
 - Flap gates or check valves may be required if the permanent pool’s water surface elevation is lower than the 10-year water elevation at the pond outlet (i.e. tailwater). If hydrographs are available for the tailwater condition, an evaluation can be performed to determine if the flap gates or check valves are required due to backwater. If hydrographs are not available, flap gates or check valves are required.
 - Flap gates and check valves shall not impede flow in down slope channels or streams.
 - Ice accumulation within the down slope conveyance system shall be considered during flap-gate/check valve and principal outlet design.
- Tailwater
 - Tailwater conditions shall be evaluated at the pond outlet.
 - Tailwater conditions along lakes, rivers and streams may be obtained from available 100-year floodplain studies.
 - Tailwater conditions may require that 1-year, 2-year, 10-year and/or 100-year, 24-hour runoff volumes be held in the pond, without release, until the down slope hydrograph allows the pond and flap gate to discharge flow.
 - It is recommended that the designer contact the local municipality to discuss tailwater conditions early in the design process. The local municipality may have information available to assist with the tailwater evaluation.
- Emergency Spillway
 - The routed 1-year, 2-year and 10-year, 24-hour design storm may not pass through the emergency spillway. The routed 100-year, 24-hour design storm may not pass through the emergency spillway if the pond is designed to have a:
 - Structural height > 6-feet and flood storage capacity >50 acre-feet, or
 - Structural height > 25-feet and flood storage capacity > 15 acre-feet.
 - Backwater from a down slope conveyance system may not pass through the emergency spillway during the 1-year, 2-year or 10-year, 24-hour design storm. Also, a backwater may not pass through the emergency spillway during the 100-year, 24-hour design storm, unless a hydrologic and hydraulic evaluation

indicates the site's peak discharge requirements are still satisfied, despite the backwater.

- When feasible, the emergency spillway should not be constructed on an embankment or over fill material. Spillways constructed on an embankment or over fill material are more prone to failure.
- The emergency spillway shall be constructed of permanent materials (i.e. poured concrete, grouted rip rap, articulated concrete block, etc.) if the spillway is constructed on an embankment. The permanent material shall extend from the top of embankment to the down slope toe of embankment. The permanent material shall be shaped to contain flows and reduce potential for erosion and embankment failure.
- Topsoil and Seeding
 - Topsoil is required in the safety shelf to encourage wetland plant growth (12-inch minimum thickness).
 - When feasible, install a wetland seed mix or mature plants in the safety shelf to improve pond safety, reduce wave erosion along the shoreline, improve pollutant removal and discourage geese residence. Use non-invasive species.
 - When feasible, maintain a high grass buffer around the permanent pool's perimeter. The high grass buffer will further improve pond safety and control of geese. Also, the perimeter of the permanent pool is typically the most difficult area to mow due to saturated soil conditions.
- Dry Detention Pond
 - Dry detention ponds shall be designed to meet requirements in Technical Standard 1001 (Wet Detention Pond), except criteria related to permanent pool, safety shelf, sediment storage, sediment forebay and aerators/fountains.
 - Dry detention ponds shall be designed to meet the local modifications provided for Technical Standard 1001 (Wet Detention Pond), except permanent pool and soil boring criteria.
 - Dry detention ponds shall not receive any water quality or TSS credit unless written approval is obtained from the WDNR. The approved letter must specifically indicate the amount of TSS credit provided by the dry pond.
 - Dry detention ponds shall have a minimum bottom slope to the principal outlet of 1%. The applicant may request a waiver if site characteristics create a hardship.
 - As part of the Operation and Maintenance Plan, sediment accumulation in the dry pond shall be monitored. Accumulated sediment shall be removed when 5% to 10% of the storage volume is lost for the 2-year, 24-hour design storm.
 - The design shall address liners, depth to bedrock, separation from wells, karst and test pits/borings.
- As-Built Drawings
- **1002 – Site Evaluation for Stormwater Infiltration**
 - A site layout should not be developed until Step B is complete. Information obtained from Step B is used to:
 - Identify soil textures within the site.
 - Identify infiltration exclusions and exemptions.

- Develop a site layout and identify potential infiltration device locations.
- For Step B, the minimum number of initial test pits or soil borings required for a new development area are as follows:
 - Two for the initial 10 acres, plus one per 10 acres thereafter.
 - One per soil unit. Soil units are depicted on NRCS Soil Survey Maps
 - Example Calculations:
 - 4 acres with 1 soil unit = min. of 2 test pits or soil borings
 - 20 acres with 2 soil units = min. of 3 test pits or soil borings
 - 20 acres with 5 soil units = min. of 5 test pits or soil borings
 - 34 acres with 3 soil units = min. of 4 test pits of soil borings
- Upon completion of Step B, it is recommended that the developer and designer meet with the municipality to discuss infiltration requirements for the development to avoid redesign during permit submittal.
- Information obtained from Step C is used to design each infiltration device. As part of Step C, a second set of test pits or soil borings are required. Refer to Table 1, Technical Standard 1002 (Site Evaluation for Stormwater Infiltration) for test pit or soil boring requirements.
- Information obtained from the site evaluation for stormwater infiltration shall be documented in the site stormwater management report following the requirements found in the Infiltration and Groundwater Evaluation Checklist and Technical Standard 1002 (Site Evaluation for Stormwater Infiltration). The site evaluation for stormwater infiltration is required for all sites with $\geq 20,000$ ft² of impervious surface disturbance or > 1-acre of land disturbance and all sites with proposed infiltration practices.
- **1003 – Infiltration Basin**
 - As-Built Drawings: Surveyed record drawings certified by a Professional Engineer shall be submitted upon completion of construction of all infiltration basins. As part of the as-built drawings, the Professional Engineer may need to verify BMP performance using computer modeling. Refer to as-built drawing checklist for requirements.
- **1004 – Bioretention for Infiltration**
 - Biofiltration systems shall be designed to meet requirements in Technical Standard 1004 (Bioretention for Infiltration), except for the storage layer and sand/native soil interface layer.
 - WinSLAMM, P8 or approved equivalent methodology shall be used to evaluate the TSS reduction associated with a bioretention or biofiltration BMP.
 - As-Built Drawings: Surveyed record drawings certified by a Professional Engineer shall be submitted upon completion of construction of all bioretention and biofiltration facilities. As part of the as-built drawings, the Professional Engineer may need to verify BMP performance using computer modeling. Also, as part of the as-built drawings, the contractor shall certify the bioretention or biofiltration device was constructed in accordance with the approved construction plans and that the installed engineered soil complies with the material specifications. Refer to as-built drawing checklist for requirements.

● **1005 – Vegetated Swale**

- The grass swale infiltration rate used in WinSLAMM or P8 shall be obtained from the Technical Standard 1002 (Site Evaluation for Stormwater Infiltration). The design infiltration rate shall be based on the most confining soil layer within 5-feet of the of the grass swale’s bottom elevation.
- Minimum longitudinal slope for a grass swale is 1%. The applicant may request a waiver if site characteristics create a hardship.
- Grass swales shall be designed for a 2-inch lawn height. If an alternative height is desired, it is recommended that the developer and designer contact the local municipality early in the design process to obtain approval. The local municipality may have ordinances or other design criteria which dictate the allowable mowing height.
- Driveway culverts shall be considered when the swale length (density) is determined for purposes of WinSLAMM or P8 modeling. The maximum allowable culvert length for each lot shall be specified on the plans.
- Minimize or mitigate soil compaction during grading activities.
- Grassed swales shall be designed for the proper drainage area. Generally, it will be best to have one or two sizes to be used wherever needed throughout the development. The design shall be based on the largest drainage area served.
- Grassed swales shall be designed according to the planned vegetation type and maintenance that will be provided. Generally, grassed channels will be designed to have stable velocities when the vegetation is shortest and adequate capacity when the vegetation is longest.
- The Operation and Maintenance Plan shall include a map showing the location of all grass swales used to meet the performance standards for a post-construction site.

● **1006 – Proprietary Storm Water Sedimentation Devices**

- Surveyed as-built drawings, certified by a Professional Engineer, shall be submitted upon completion of construction of all proprietary storm water sedimentation devices, hydrodynamic devices and catch basins or manholes with sumps. As part of the record drawings, the Professional Engineer may need to verify BMP performance using computer modeling. Refer to the surveyed as-built drawing checklist for requirements. The Operation and Maintenance Plan shall include a map showing the location of all proprietary storm water sedimentation devices, hydrodynamic devices and catch basins or manholes with sumps used to meet the performance standards for a post-construction site.

● **1007 – Infiltration Trench**

- Surveyed as-built drawings, certified by a Professional Engineer, shall be submitted upon completion of construction of all infiltration trenches. As part of the record drawings, the Professional Engineer may need to verify BMP performance using computer modeling. Refer to the surveyed as-built drawing checklist for requirements.
- The Operation and Maintenance Plan shall include a map showing the location of all infiltration trenches used to meet the performance standards for a post-construction site.

● **1008 – Permeable Pavement**

- Surveyed as-built drawings, certified by a Professional Engineer, shall be submitted upon completion of construction of all permeable pavements. As part of the as-built drawings, the Professional Engineer may need to verify BMP performance using computer modeling. Refer to surveyed as-built drawing checklist for requirements.
- The Operation and Maintenance Plan shall include a map showing the location of all permeable pavement used to meet the performance standards for a post-construction site.

● **1009 – Rain Gardens**

- Surveyed as-built drawings, certified by a Professional Engineer, shall be submitted upon completion of constructed rain gardens. As part of the surveyed as-built drawings, the Professional Engineer may need to verify BMP performance using computer modeling. Refer to surveyed as-built drawing checklist for requirements.
- The Operation and Maintenance plan shall include a map showing the location of all rain gardens used to meet the performance standards for a post-construction site.

(3) GUIDANCE DOCUMENTS

The following are the applicable Guidance Documents:

- S100 Compost
- Guidance for the Establishment of Protective Areas for Wetlands
- “Construction Site” Definition – “Common Plan of Development”
- Modeling Post-Construction Storm Water Management Treatment
- Meeting Infiltration Performance Standard of ch NR 151
- Wetland Screening and Delineation Procedures
- Technical Note for Sizing Infiltration Basins and Bioretention Devices
- Technical Note for Conducting Pavement Surface Infiltration Rate, Pollutant Load and Runoff Volume Reduction Modeling
- Rain Gardens: A guide for homeowners and landscapers
- Estimating Residue Using the Line Transect Method (UW-Extension A3533)
- The Wisconsin Stormwater Manual
- WisDOT – Facilities Development Manual
- WisDOT Standard Specifications for Highway and Structure Construction
- Other relevant WDNR stormwater guidance documents
- Other National Publications

(4) LOCAL EASEMENT REQUIREMENTS

- Easements are typically required for BMPs and conveyance systems that serve more than one property owner or lot. Conveyance systems include storm sewers, grass swales, channels, streams and overland relief paths. Easement widths will vary.
- An ingress/egress easement or direct access to a public street is typically required for BMPs that serve more than one property owner or lot.
- It is recommended that the developer and designer contact the local municipality early in the design process to discuss easements and width requirements.

S.07 PERFORMANCE STANDARDS

- (1) RESPONSIBLE PARTY
- (2) PLAN
- (3) REQUIREMENTS

(a) Water Quality

Post-construction sites with 1-acre or more of land disturbance, or within a TMDL watershed, are required to meet the ordinance’s numeric performance standards. All other post-construction sites are not required to meet these numeric performance standards. BMP design guidance is provided below in S.07(3)(h) for sites with less than 20,000 ft² of impervious surface disturbance.

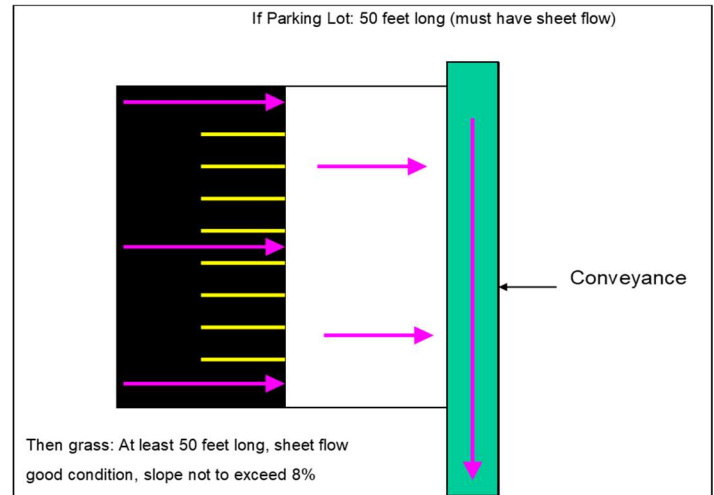
- **Computer Models:** Pollutant loading models such as WinSLAMM, DETPOND, P8 or an approved equivalent methodology may be used to evaluate the efficiency of the design in reducing pollutants. Use the most recent version of WinSLAMM, DETPOND and P8. The applicant may request a waiver of this requirement.
- **Design Clarifications:** “No Controls” is the baseline condition for each site. No TSS credit is provided for meeting the baseline condition. The baseline condition is defined as follows:
 - Assume site is stabilized (no erosion)
 - Assume proposed impervious surfaces are in place. Impervious surface reductions (e.g. reduced street width, etc.) cannot be used to claim TSS credit; however; impervious surface reductions will lower runoff volumes which will reduce the required size for stormwater management BMPs.
 - Assume no stormwater management BMPs
 - Assume curb and gutter/storm sewer drainage system in fair condition.
 - If the applicant intends to claim TSS credit for disconnecting an impervious surface, the “No Controls” condition shall be based on the “typical” percent connected impervious values established by the WDNR:

LAND USE	% CONNECTED	LAND USE	% CONNECTED
Open space / undeveloped	5	Freeway	51
Suburban Residential	7	Multi-Family Residential	51
Park	10	Miscellaneous Institutional	59
Cemetery	12	Medium Industrial	64
Low Density Residential	14	High Rise Residential	65
Medium Density Residential – With Alley	25	Light Industrial	71
Medium Density Residential – No Alley	28	Office Park – Commercial	74
Schools – Institutional	39	Hospital – Institutional	76
High Density Residential – With Alley	42	Commercial Strip Mall	91
High Density Residential – No Alley	42	Shopping Center – Commercial	91
Mobile Home Residential	47	Commercial Downtown	96

- **Disconnection:** TSS credit is provided for runoff volume reductions associated with disconnecting impervious surfaces beyond the “typical” percent connected impervious values established by the WDNR. In order to consider an impervious surface as “disconnected”, the following criteria shall be met:
 - Residential Roofs: Discharge runoff over a minimum 20-foot long pervious surface that is in good condition and graded for sheet flow.

- Other Impervious Surfaces
 - Source area flow length may not exceed 75-feet
 - Source area and pervious area must be graded for sheet flow.
 - Pervious area must be in good condition, have a slope less than 8% and have a flow length at least as long as the contributing impervious area's length (but never less than 20-feet).

Source: WDNR Post-Construction
Stormwater Management Workshops



- **Street Sweeping and Catch Basin Cleaning:** No TSS credit is provided for street sweeping, catch basin cleaning or other management type BMPs in new developed areas.
- **Infiltration Rate:** The design infiltration rate for a BMP shall be based on the most confining soil layer within 5-feet of the BMPs bottom elevation Infiltration rates shall be obtained from Technical Standard 1002 (Site Evaluation for Stormwater Infiltration).
- **Vegetated Infiltration Swale:** The grass swale infiltration rate used in WinSLAMM or P8 shall be obtained from Technical Standard 1002 (Site Evaluation for Stormwater Infiltration). For WinSLAMM, the typical swale geometry shall be entered in lieu of using the “Wetted Width” option. WinSLAMM will calculate the “Wetted Width” for each rain event based on the typical swale geometry.
- **Uncontrolled areas:** The performance standard for TSS is a site standard, not a BMP standard. Often, a site contains uncontrolled areas that do not flow through a BMP (e.g. wet pond, grass swale, etc.). Typically, it is necessary to increase the TSS reduction provided by other on-site BMPs in order to offset or over-compensate for these uncontrolled areas.
- **Routine Maintenance Areas:** No performance standard or TSS reduction is required for routine maintenance areas; however; the applicant is responsible for proper performance of on-site BMPs. In order to ensure proper BMP performance, the applicant has these two options:
 - Divert the routine maintenance area around on-site BMPs, or
 - Include runoff volumes from the routine maintenance area in on-site BMP calculations; however; no TSS credit is provided for the routine maintenance area unless it is re-classified as redevelopment.
- **Offsite Drainage Areas:** The applicant is not responsible for satisfying TSS performance standards for off-site areas that drain into the project site; however, the applicant is

responsible for proper performance of on-site BMPs. In order to ensure proper on-site BMP performance, the applicant has these two options:

- Divert off-site runoff around on-site BMPs, or
- Include off-site runoff volumes in on-site BMP calculations. The amount of on-site TSS credit is determined by multiplying the BMPs percent TSS reduction by the base TSS load for the on-site area.

EXAMPLE CALCULATIONS

The development site currently contains 30-acres of institutional land uses and 70-acres of agricultural land uses. The entire 100-acre site will be disturbed as part of the proposed project. Within the 100-acre site, the developer plans to:

- Redevelop 20-acres (existing institutional) into a new commercial area.
- Conduct routine maintenance on 10-acres of existing asphalt parking lot (existing institutional). Parking lot will be part of the new commercial area.
- Develop 70 acres (existing agriculture) into a new residential area

The “No Controls” or base TSS load is computed as follows:

- Commercial area: 20-acres x 600 lbs/acre = 12,000 lbs.
- Residential area: 70-acres x 400 lbs/acre = 28,000 lbs.
- **“No Controls” TSS Load: 12,000 + 28,000 = 40,000 lbs.**

The “TSS Reduction Required” is computed as follows:

- Commercial area: 12,000 lbs x 40% (redevelopment) = 4,800 lbs
- Residential area: 28,000 lbs x 80% (new development) = 22,400 lbs
- **“TSS Reduction Required”: (4,800 + 22,400)/40,000 = .68 or 68%**

A wet pond is proposed for the site. The pond achieves an 80% TSS reduction for its 130-acre watershed. The 130-acre watershed includes 20-acres of commercial area, 10-acres of commercial parking lot, 60-acres of residential area and 40-acres of offsite residential area.

- Commercial area (20 ac): 12,000 lbs x 80% (wet pond) = 9,600 lbs
- Commercial parking lot (10 ac): 8,000 lbs x 80% (wet pond) = 6,400 lbs
- Residential area (60 ac): 24,000 lbs x 80% (wet pond) = 19,200 lbs
- Offsite residential area (40 ac): 16,000 lbs x 80% (wet pond) = 12,800 lbs
- **Pond TSS Reduction: (9,600 + 6,400 + 19,200 + 12,800)/60,000 = .80 or 80%**

The “TSS Reduction Provided” is computed as follows:

- Commercial Area (20ac): 12,000 lbs x 80% (wet pond) = 9,600 lbs
- Commercial parking lot (10 ac): SEE NOTE #1 BELOW
- Residential area (60 ac): 24,000 lbs x 80% (wet pond) = 19,200 lbs
- Residential area (10 ac): 4,000 lbs x 0% (uncontrolled) = 0 lbs
- Off-site residential area (40 ac): SEE NOTE #2 BELOW
- **“TSS Reduction Provided”: (9,600 + 19,200 + 0)/40,000 = .72 or 72%**

72% > 68%, therefore the TSS requirement is satisfied

Note #1: In this example, the 10-acre commercial parking lot could have been included in the “TSS Reduction Required” and “TSS Reduction Provided” calculations if it was reclassified as redevelopment, as opposed to routine maintenance. The reclassification would have allowed the applicant to plan for future reconstruction of the 10-acre commercial parking lot.

Note #2: In this example, the 40 acre off-site residential area could have been included in the “TSS Reduction Required” and TSS Reduction Provided” calculations if it was a regional pond, as opposed to an on-site pond. A regional pond would have allowed the owner of the 40-acre off-site residential area to take credit for the TSS reduction provided by the wet pond.

(b) Peak Discharge

Post-construction sites with 20,000 ft² or more of impervious surface disturbance and post-construction sites with 1-acre or more of land disturbance are required to meet the ordinance's numeric performance standards. All other post-construction sites are not required to meet these numeric performance standards. BMP design guidance is provided below in S.07(3)(h) for sites with less than 20,000 ft² of impervious surface disturbance. Agriculture BMPs and design clarifications are found in S.07(8).

- **Computer Models:** Peak discharge rates shall be evaluated using TR-55 methodology and a computer model. The computer model shall be able to use the MSE3 or MSE4 rainfall distribution. Each pre-development watershed shall be evaluated for peak discharge. It is not accurate or necessary to "link" all of the pre-development watersheds to determine the ultimate allowable discharge for the site. The allowable discharge for each outfall shall be determined based on the individual pre-development watershed as discussed more in-depth below in "TR-55 Methodology Clarifications".

- **TR-55 Methodology Clarifications:**

- Time of Concentration (T_c)
 - Pre-development Requirements
 - The T_c route shall be the route that takes the longest time to reach the outfall and not necessarily the furthest point in the watershed.
 - The T_c route shall be shown to scale on the pre-development contours with each flow segment labeled.
 - The pre-development T_c should typically be at least 30 minutes in NE Wisconsin. This may not apply to small sites.
 - A Manning's "n" value of 0.24 shall be used for sheet flow "meadow" conditions. For redevelopment areas, assume impervious surfaces do not exist.
 - The sheet flow length before development in NE Wisconsin is usually 250-feet to 300-feet. This may not apply to small sites.
 - For shallow, concentrated flow, "unpaved" or "paved" shall be used to represent vegetated swales and paved swales, respectively.
 - Post-Development Requirements
 - The T_c route shall incorporate and represent the development. If the development is large, consider dividing the development into multiple watersheds.
 - T_c will almost always be shorter after development.
 - The T_c route shall be shown to scale on the post-development drainage plan with each flow segment labeled.
 - The sheet flow length after development will seldom be greater than 50-feet to 100-feet due to the grading around homes and buildings. A sheet flow length of greater than 100-feet requires approval from the reviewing authority (except for large, paved parking areas).
 - A Manning's "n" value of 0.24 is appropriate for sheet flow "lawn" conditions.
 - The minimum sheet flow slope shall be 2% for residential lawns.

- For shallow, concentrated flow; “unpaved” or “paved” shall be used to represent vegetated swales and paved swales, respectively.
- The T_c flow path stops when it reaches the inflow of a wet or dry detention basin.
- The post-development T_c is important for determining the correct storage volume required. See the Storage Volume for Detention Basins section below.

○ RCNs

▪ Pre-development Requirements

- The following Curve Numbers shall be used for “meadow” conditions:

Maximum Pre-Development Runoff Curve Numbers (meadow)				
Hydrologic Soil Group	A	B	C	D
Curve Number	30	58	71	78

- Existing concentrated wooded areas shall be modeled as “Woods, Good Hydrologic Condition” with curve numbers of 30, 55, 70 and 77 for hydrologic soil groups A, B, C and D, respectively.
- Soil units can be found in the applicable County Soil Survey (or, if provided, on the [Municipalities] website).
- The appropriate hydrologic soil groups are located on the NRCS Soil Survey website.

❖ Notice that a number of soils have different hydrologic soil groups than those shown in the original County USDA Soils book. The Internet groups are the ones to utilize.

▪ Post-development Requirements

- The RCN for lawns shall be used for developed areas that will be vegetated. Woods, wetland or prairie areas preserved with a recorded document may be modeled as such.

▪ Pre/Post-development Curve Number Determined for Permeable Soils

- Refer to the Site Evaluation for Infiltration Report to verify that soils mapped in hydrologic groups A or B are well drained. If not well drained, use the County USDA Soils Books hydrologic group explanation to determine the appropriate hydrologic group.
- If the existing site consists of multiple hydrologic groups, especially a combination of highly permeable and non-permeable, consideration shall be given to the proposed sit balance cut/fill. See Appendix A of TR-55 for discussion on disturbed soil profiles as a result of urbanization.

EXAMPLE: The site consists of 30% Hydrologic Group A soils and 70% Hydrologic Group C soils. The following scenarios shall be handled as noted:

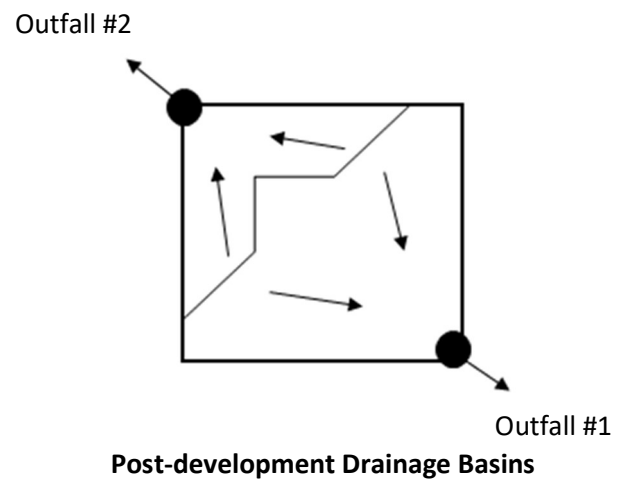
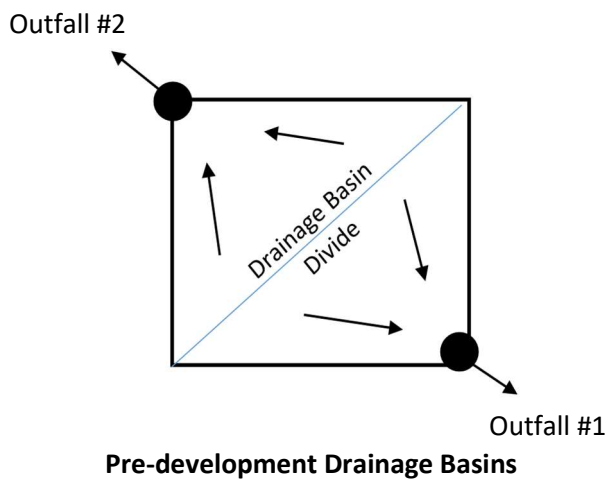
- 1) If the site earthwork does not balance within the respective Hydrologic Group and it is anticipated that the “C” soils will be filled on the “A” soils, the “c” soil RCN shall be used.
- 2) If the site earthwork balances within each respective Hydrologic Group and it is anticipated that offsite fill will be required to achieve the desired dwelling elevations, the “C” soil RCM shall be used.
- 3) If the site balances within each respective Hydrologic Group and no or minimal fill is anticipated on the “A” soils, compaction mitigation shall be provided.

- Drainage Area
 - Pre-development Requirements
 - Determine the total contributing drainage area to the development, including the offsite properties.
 - If the pre-developed site consists of multiple drainage basins, each outfall shall be evaluated for peak discharge.

EXAMPLE

The pre-development site shown **below (Left)** is 40-acres and consists of 2 drainage basins, each 20-acres in size. Each outfall has a peak discharge of 4, 8 and 12 cfs for the 1, 2, 10 and 100-year design storms, respectively.

The post-development site shown **below (Right)** is the same 40-acres; however; Outfall 1 is now a 30-acre drainage while Outfall #2 is 10-acres.



The post-development discharges for Outfall 2 are 3,6 and 9 cfs for the 1-, 2-, 10- and 100-year design storms, respectively. Outfall 2 meets the peak discharge requirements of the Ordinance because the post-development peak discharges are below the pre-development discharges for Outfall 2.

The post-development discharges for Outfall 1 are 12, 24 and 36 cfs for the 1-, 2-, 10- and 100-year storms, respectively. Outfall 1 does not meet the peak discharge requirements of the Ordinance. Stormwater facilities have to be installed to lower the post-development peak discharges to the pre-development discharges of 4, 8 and 12 cfs for the 1-, 2-, 10- and 100-year design storms, respectively.

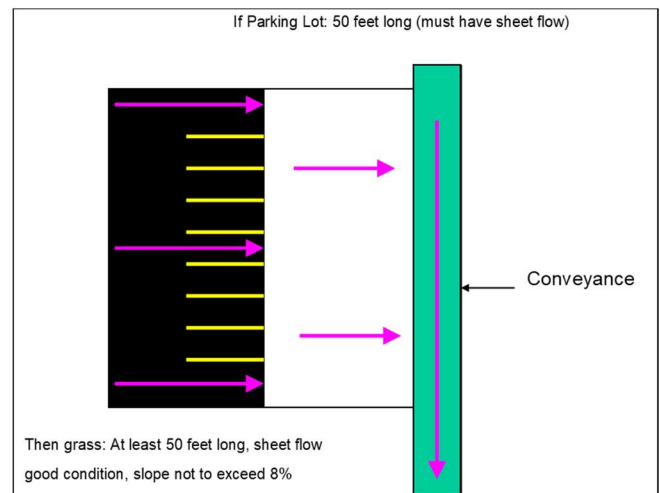
Below is an example of appropriate Stormwater Management Plan summary tables as required:

Design Storm	1-year	2-year	10-year	100-year
Pre-Development Peak Discharges				
Outfall 1	3 cfs	4 cfs	8 cfs	12 cfs
Outfall 2	3 cfs	4 cfs	8 cfs	12 cfs
Post-Development Peak Discharges				
Outfall 1 (undetained)	1.8 cfs (9 cfs)	3.6 cfs (12 cfs)	7.5 cfs (24 cfs)	10.9 cfs (36 cfs)
Outfall 2	3 cfs	3 cfs	6 cfs	9 cfs

- Post-development Requirements
 - The design of stormwater runoff control facilities shall be based on the total contributing drainage area, not just the area being developed. Any off-site drainage area must be included in the planned facilities or safely diverted around the planned facilities.
 - Off-site contributing areas that are not diverted must use the meadow condition RCN for pre-development flow computations whether the off-site area is presently developed or not.
 - Off-site contributing areas that are diverted shall use the highest anticipated RCN for the offsite area for a safe design. Also, the diversion shall provide adequate freeboard for the 100-year flow as determined by a professional engineer and assume 10% settlement for the fill area. The conveyance shall be contained within an easement. The discharge location for the diversion shall be at the pre-development outfall or at a stable location.
 - If more than 30% of the drainage area will be impervious, it will often be necessary to divide the drainage area into a pervious sub-area and impervious sub-area for correct computation of peak flow.
- Peak Discharge Method
 - Use Atlas 14, MSE4 24-hour rainfall distribution for design storms.
 - Natural depressions shall be evaluated or considered when determining peak discharge rates for the pre-development condition.
- Storage Volume for Detention Basins (TR-55)
 - The approximate storage-routing curves should not be used if the adjustment for ponding (discussed above in the peak discharge section) is used.
 - This manual method is good for determining quick estimates of the effects of temporary detention on peak discharges. Computer programs that utilize TR-20 provide more accurate methods of analysis and routing.
 - The procedure should not be used to perform final design if an error in storage of 25% cannot be tolerated.
 - When the peak outflow discharge is too close to post-development peak inflow discharge, parameters that affect the rate of rise of a hydrograph become especially significant.
- **Design Clarifications:** It is recommended that the developer and designer contact the local municipality to discuss peak discharge requirements for the site early in the design process. The local municipality may have adopted alternative peak discharge requirements for the site which are different than the Post-Construction Stormwater Management Ordinance. At a minimum, the peak discharge requirements contained in NR151 shall be met.
- Outfalls
 - Performance standards for peak discharge shall be satisfied at each outfall associated with the site. Written approval is required from down slope property owners if post-development peak discharge rates are not less than or equal to pre-development peak discharge rates at each outfall.

- Disconnection
 - Disconnecting impervious surfaces can help achieve the peak discharge requirement. Disconnecting impervious surfaces not only reduces runoff volumes, but also increases time of concentrations. In order to consider an impervious surface as “disconnected”, the following criteria shall be met:
 - Residential Roofs: Discharge runoff over a minimum 20-foot long pervious surface that is in good condition and graded for sheet flow.
 - Other Impervious Surfaces
 - Source area flow length may not exceed 75-feet
 - Source area **AND** pervious area must be graded or sheet flow.
 - Pervious area must be in good condition, have a slope less than 8%, and have a flow length at least as long as the contributing impervious area’s length (but never less than 20-feet).

Source: WDNR Post-Construction
Stormwater Management Workshops



- Uncontrolled Areas
 - The performance standard for peak discharge is an outfall standard. Often, a site contains an uncontrolled area for each outfall that does not flow through a BMP (e.g. wet pond, etc.). Typically, it is necessary to increase the peak discharge control provided by the on-site BMP in order to offset or over-compensate for the uncontrolled area.
- Routine Maintenance Areas
 - No performance standard or peak discharge reduction is required for routine maintenance areas; however, the applicant is responsible for proper performance of on-site BMPs. In order to ensure proper BMP performance, the applicant has these two options:
 - Divert the routine maintenance area around any on-site BMPs, or
 - Include runoff volumes from the routine maintenance area in on-site BMP calculations. For the pre-development condition, routine maintenance areas shall be modeled as a meadow land use. For the post-development condition, routine maintenance areas shall be modeled using the actual site conditions.

(c) Infiltration

Post-construction sites with 20,000 ft² or more of impervious surface disturbance and post-construction sites with 1-acre or more of land disturbance are required to meet the ordinance's numeric performance standards. All other post-construction sites are not required to meet these numeric performance standards. BMP design guidance is provided below in S.07(3)(h) for sites with less than 20,000 ft² of impervious surface disturbance.

- **Computer Models:** A model that calculates runoff volume, such as RECARGA, WinSLAMM, P8, TR-55 or an approved equivalent methodology may be used to evaluate the efficiency of the infiltration design. Information on how to access RECARGA, WinSLAMM or P8 is available on the WDNR website.

Use the most recent version of RECARGA, WinSLAMM and P8. The applicant may request a waiver of this requirement.

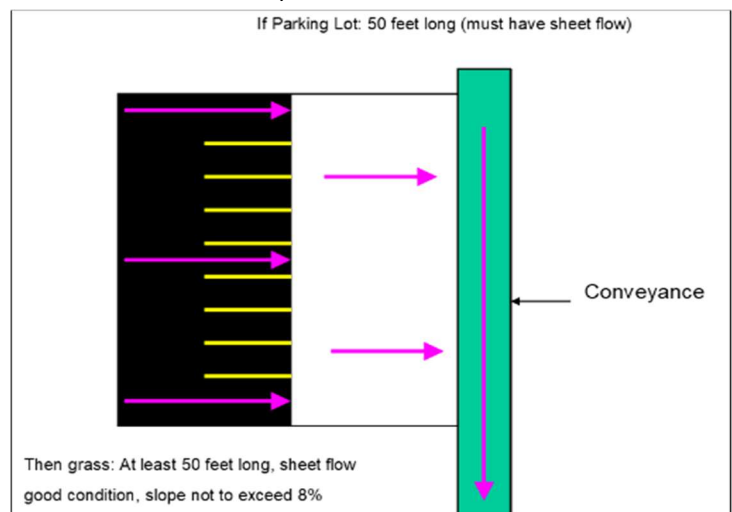
Depending on the type of infiltration device, groundwater mounding may need to be evaluated. A model that calculates groundwater mounding is available on the WDNR website.

- **Design Clarifications**

- Maximum required Effective Infiltration Area (EIA) is calculated as follows:
 - For developments with up to 40% connected imperviousness, the EIA cap is 1% of the project site. The project site is defined as the area of land disturbance.
 - For developments with greater than 40% connected imperviousness, the EIA cap is 2% of the project site. Excluded and exempted areas are included in the EIA cap calculation.
 - The maximum required EIA cap may be voluntarily exceeded.
- Exclusions: Infiltration from source areas or at locations identified in section S.07(3)(c)9 of the ordinance is not prohibited. Rather, credit will not be given toward achieving the infiltration requirement. Runoff from excluded areas does not have to be included in calculating the infiltration goal; however, if runoff from an excluded area flows through an infiltration BMP, the following is required:
 - Use caution: these source areas and locations are excluded from the ordinance's infiltration requirement due to groundwater contamination concerns. The municipality is not responsible for the applicant's decision to infiltrate this runoff. The applicant is solely responsible for NR 140 compliance and groundwater protection.
 - The BMP design must take runoff from excluded areas into account to assure the device can safely handle the additional flow and volume.
- Exemptions: Infiltration from source areas or at locations identified in S.07(3)(c)10 of the ordinance is not required. Despite the ordinance, the applicant may choose to infiltrate exempted runoff. If exempted runoff is infiltrated, credit will be given toward achieving the infiltration requirement. Runoff from exempted areas does not have to be included in calculating the infiltration goal; however, if runoff from an exempted area flows through an infiltration BMP, the BMP design must take it into account to assure the device can safely handle the additional flow and volume.

- Groundwater Protection: It is the applicant’s sole responsibility to protect groundwater. Compliance with Preventive Action Limits (PAL) contained in NR 140 must be maintained. Also, infiltration system discharges must remain below Enforcement Standards (ES) contained in NR 140. WDNR Technical Standards should meet these groundwater protection requirements.
- Maximum Extent Practicable (MEP):
 - Definition takes into consideration best available technology, cost-effectiveness, natural resource protection, historic preservation, human safety and welfare and site conditions (see ordinance).
 - Topography: To achieve the infiltration requirement, maximum extent practicable should not be interpreted to require significant topography changes that create an excessive financial burden. Two feet or less of elevation change is considered reasonable and to the MEP.
 - Pumping: To achieve the infiltration requirement, maximum extent practicable should not be interpreted to require stormwater pumping.
- Roof Runoff: To minimize potential groundwater impacts, it is desirable to infiltrate the cleanest runoff. To achieve this, a design may propose greater infiltration of runoff from low pollutant sources, such as roofs, and less from higher pollutant source areas, such as parking lots.
- Disconnection: Disconnection of impervious surfaces can be used to help achieve the infiltration requirement; however, disconnection is not considered to be part of an infiltration system. Therefore, disconnected areas do not count toward the maximum effective infiltration area calculation. In order to consider an impervious surface as “disconnected”, the following criteria shall be met:
 - Residential roofs: Discharge runoff over a minimum 20-foot long pervious surface that is in good condition and graded for sheet flow.
 - Other impervious surfaces:
 - Source area flow length may not exceed 75-feet.
 - Source area **AND** pervious area must be graded for sheet flow.
 - Pervious area must be in good condition, have a slope less than 8% and have a flow length at least as long as the contributing impervious area’s length (but never less than 20-feet)

Source: WDNR Post-Construction
Stormwater Management Workshops



- Routine Maintenance Areas: No performance standard or infiltration requirement is provided for routine maintenance areas; however, the applicant is responsible for proper performance of on-site BMPs. In order to ensure proper BMP performance, the applicant has two options:
 - Divert the routine maintenance area around on-site BMPs, or
 - Include runoff volumes from the routine maintenance area in on-site BMP calculations. The applicant will receive credit for infiltrating runoff from the routine maintenance area provided it is not an excluded area.
- Off-site Drainage Areas: The applicant is not responsible for satisfying infiltration performance standards for off-site areas that drain into the project site; however, the applicant is responsible for proper performance of on-site BMPs. In order to ensure proper on-site BMP performance, the applicant has two options:
 - Divert off-site runoff around on-site BMPs, or
 - Include off site runoff volumes in the on-site BMP calculations. The amount of on-site credit is determined by pro-rating the infiltration volume. The applicant will not receive credit for infiltrating off-site runoff unless the BMP is a regional facility.
- Alternative Uses: The volume of runoff used for alternative uses will be credited towards the infiltration requirement. Alternative uses may include toilet flushing, laundry and irrigation (E.G. cisterns, rain barrels, green roofs, etc.). In addition to the stormwater benefits, these alternative uses may also reduce municipal invoices for drinking water.

EXAMPLE CALCULATIONS

The site is currently 100-acres of cropland. Following development, the site will be 30-acres medium residential, 20-acres commercial and 50-acres cropland. Native soils in the area to be developed are sandy loams, silt loams and silty clay loams. Hydrologic soil groups are B and C with an average pre-development curve number of 75. A site investigation using Step B of the WDNR Technical Standard 1002 (Site Evaluation for Stormwater Infiltration), determined that 10 of the acres to be developed into medium residential have an infiltration rate of 0.10 in/hr and are therefore exempt from the infiltration requirements. The site investigation also determined that 10 acres to be developed into commercial are excluded from the infiltration requirements. The post-development curve number for pervious portions of the residential and commercial components will be 80, based on TR-55. The residential component will be 40% impervious. The commercial component will be 80% impervious.

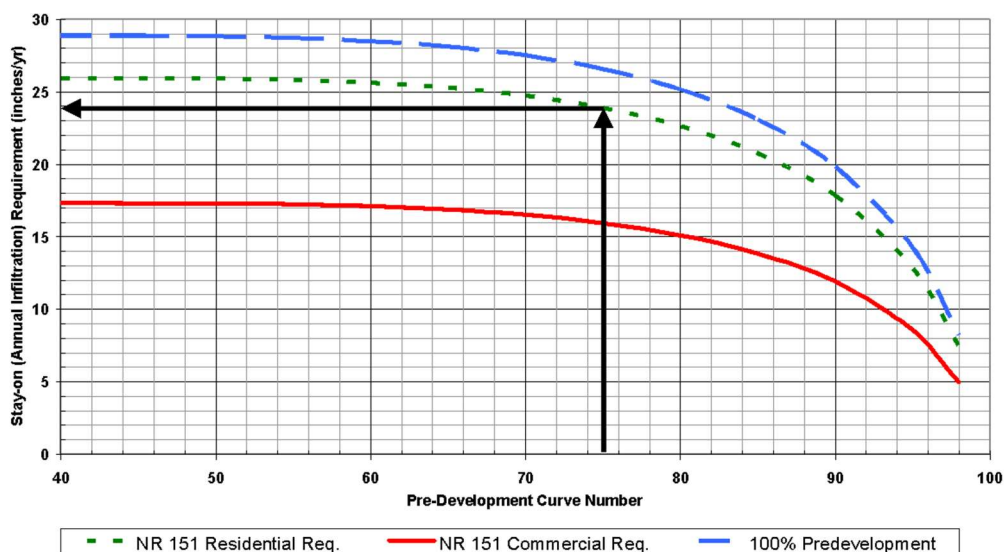
The residential and commercial components will meet the infiltration requirements using two infiltration basins. Upon completion of a preliminary site layout, two locations were chosen for investigation using Step C of Technical Standard 1002 (Site Evaluation for Stormwater Infiltration). The first location investigated was in the residential area that is not exempt from the infiltration requirements. The soil texture at the residential infiltration basin site is a sandy loam with a design infiltration rate of 0.5 in/hr. The second location investigated was in the commercial area that is not excluded from the infiltration requirements. The soil texture at the commercial infiltration basin is a loamy sand with a design infiltration rate of 1.63 in/hr.

STEP 1: DETERMINE INFILTRATION BASIN SIZE – RESIDENTIAL COMPONENT

Step 1A: Determine Target Stay-on Depth – Residential

Using Chart 1, the target stay-on depth is **24-inches** per year.

CHART 1 - TARGET STAY-ON (ANNUAL INFILTRATION) REQUIREMENT
Based on the annual 1981 Rainfall for Madison, WI

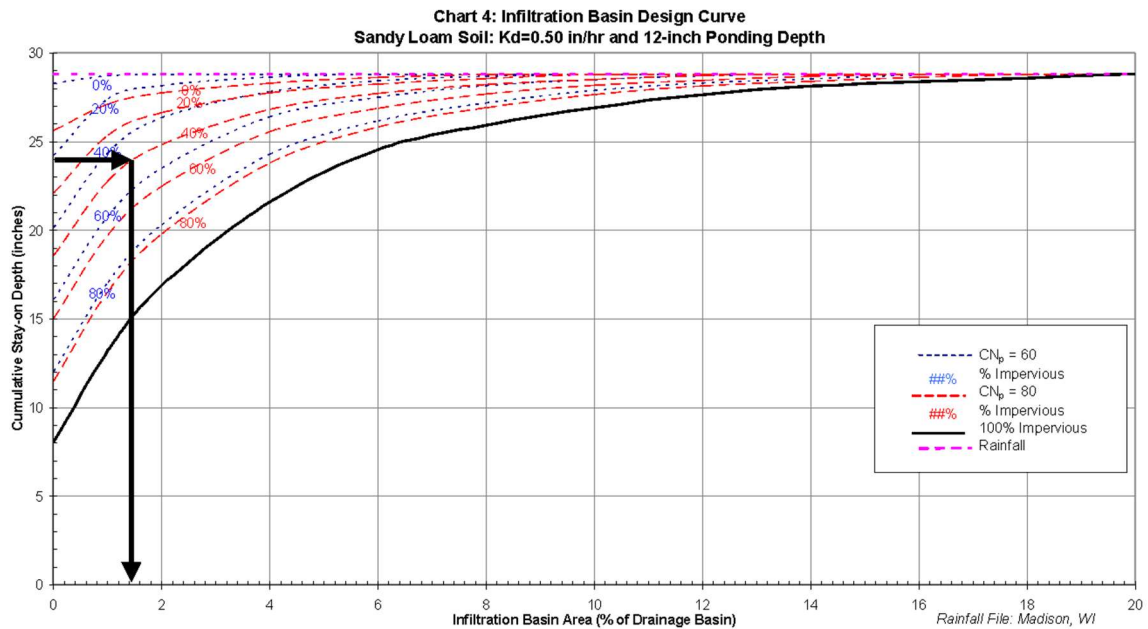


Note: 100% Predevelopment represents infiltration under predevelopment conditions

EXAMPLE CALCULATIONS, CON'T

Step 1B: Determine Preliminary Effective Infiltration Area - Residential

Using Chart 4, the preliminary effective infiltration area needed for the infiltration basin is **12,197 ft²** (43,560 * x 20-acres x 1.4%).



Step 1C: Maximum Required Effective Infiltration Area – Residential

- Residential Land Disturbance (30-acres total)
 - Building roof: 5-acres
 - Driveway and Sidewalk 2-acres
 - Street 5-acres
 - Lawn/Landscaping 18-acres
- Maximum required EIA = **13,068 ft²** (43,560 x 30-acres x 1%)

Step 1D: Determine Final Effective Infiltration Area – Residential

Using WDNR Technical Standard 1003 (Infiltration Basin), the preliminary effective infiltration area of 12,197 ft² needs to be adjusted (depth, slope, cell configuration) to determine the final effective infiltration area. Groundwater mounding also needs to be checked. **The maximum EIA cap does not appear to impact the infiltration basin's size (12,197 ft² < 13,068 ft²).**

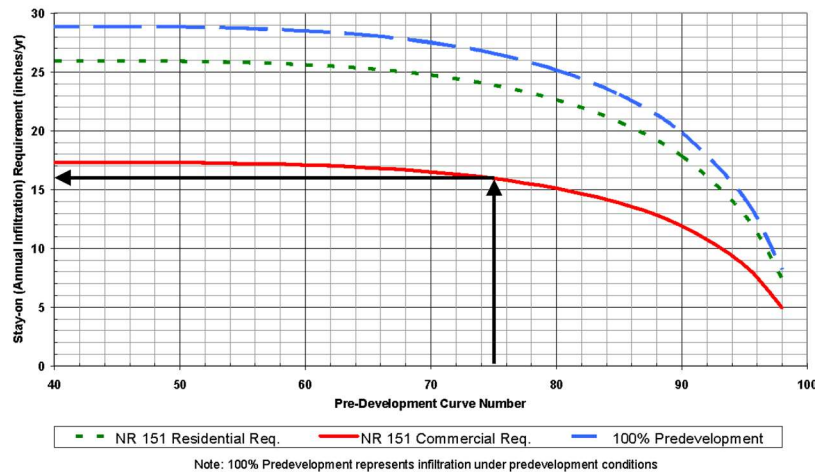
STEP 2: DETERMINE INFILTRATION BASIN SIZE – COMMERCIAL COMPONENT

Step 2A: Determine Target Stay-on Depth – Commercial

Using Chart 1, the Target Stay-on depth is **16-inches/year**.

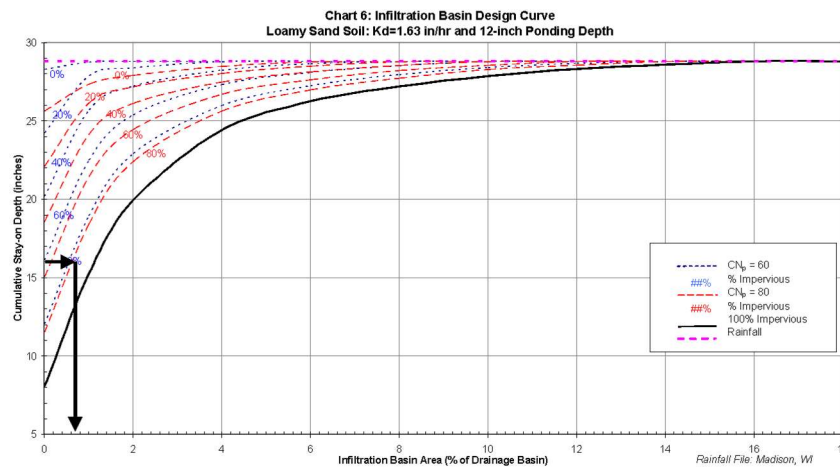
EXAMPLE CALCULATIONS, CON'T

CHART 1 - TARGET STAY-ON (ANNUAL INFILTRATION) REQUIREMENT
Based on the annual 1981 Rainfall for Madison, WI



Step 2B: Determine Preliminary Effective Infiltration Area – Commercial

Using Chart 6, the preliminary effective infiltration area needed for the infiltration basin is 2,614 ft² (43,560 x 10-acres x 0.6%)



Step 2C: Maximum Required Effective Infiltration Area – Commercial

- Non-Residential Land Disturbance (20-acres total)
 - Building roof 6-acres
 - Parking lot 7-acres
 - Street 3-acres
 - Lawn/Landscaping 4-acres
- Maximum Required EIA = **11,326 ft²** (43,560 x 13-acres x 2%)

Step 2D: Determine Final Effective Infiltration Area – Commercial

Using WDNR Technical Standard 1003 (Infiltration Basin), the preliminary effective infiltration area of 2,614 ft² needs to be adjusted (depth, slope, cell configuration) to determine the final effective infiltration area. Groundwater mounding also needs to be checked. **The maximum EIA cap does not appear to impact the infiltration basins size (2,614 ft² > 11,326 ft²).**

(d) Protective Areas

All Post-Construction sites are required to meet the ordinance's protective area performance standards.

More information on wetland types and ephemeral ponds can be found on the WDNR website.

The following diagrams are examples of how protective areas interact with each other when more than one type of waterbody is present. The diagrams can also be found in the WDNR wetland protective area guidance document.

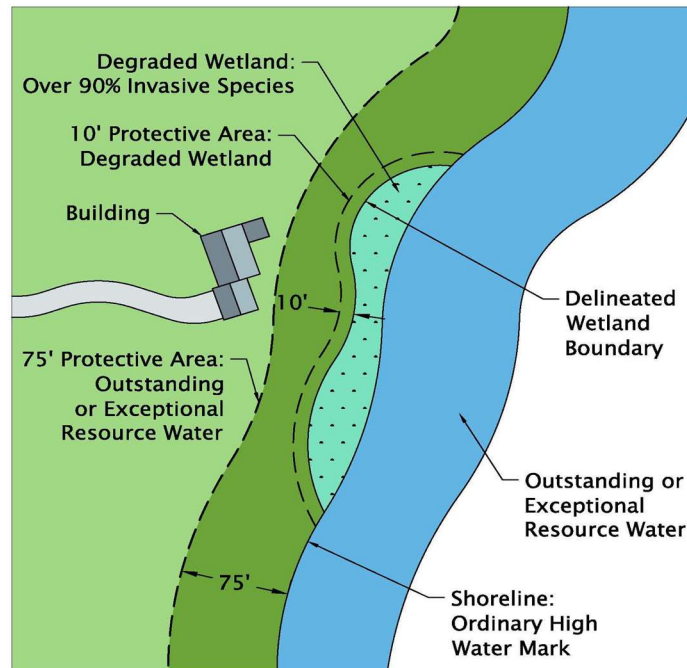


Figure 1: NR 151.125 Protective Area at Outstanding Resource Water with Degraded Wetland

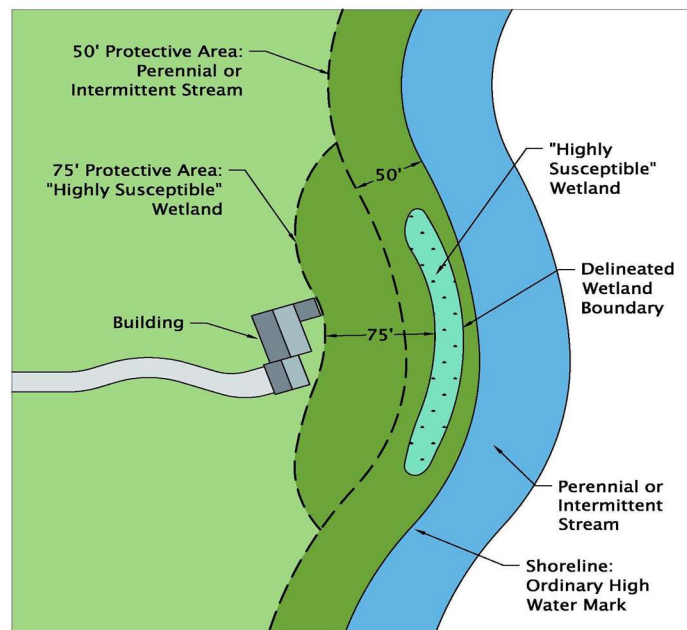


Figure 2: NR 151.125 Protective Area at "Highly Susceptible" Wetland with Perennial Stream

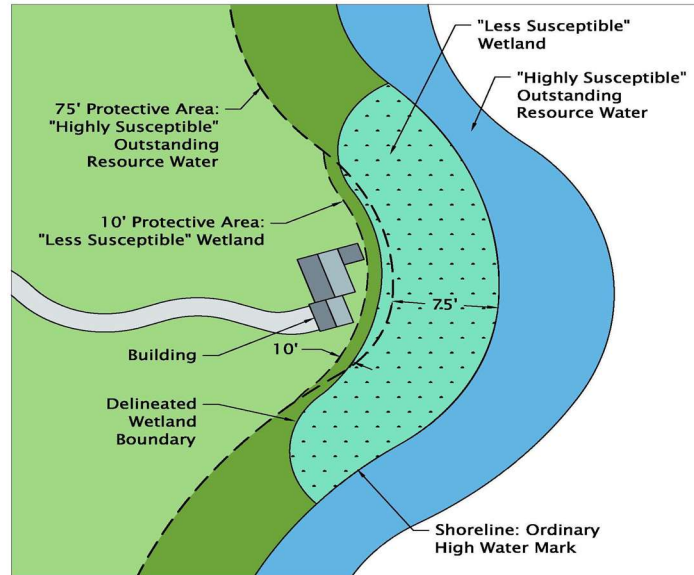


Figure 3: NR 151.125 Protective Area with "Less Susceptible" Wetland beyond Outstanding Resource Water

The following diagram illustrates how to determine the average width of a less susceptible wetland. This diagram is taken from the WDNR wetland protective area guidance document.

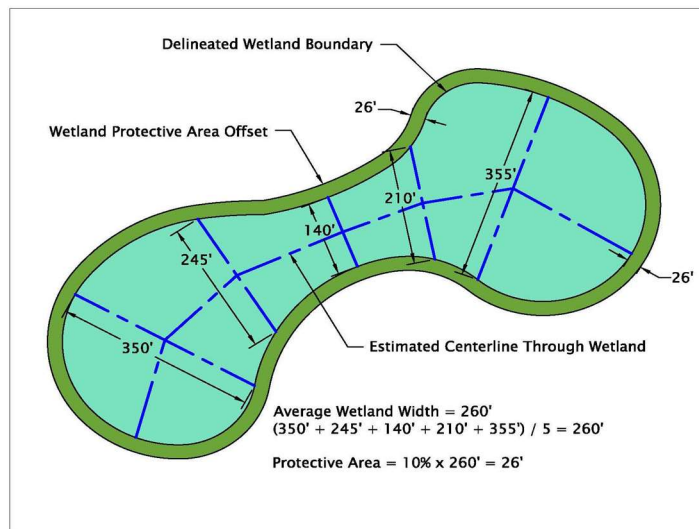


Figure 4: NR 151.125 Calculating Average Wetland Width

● **Design Clarifications:**

- Adjacent Property Owners: If a stream or channel is placed or relocated along a property line, an easement or letter of permission is required from any property owners impacted by the protective area's new location. Also, if a stormwater facility or structure is proposed within an on-site stream or channel, 100-year flood elevations shall be evaluated to determine if off-site property owners are impacted by backwater or a flood elevation increase. An easement or letter of permission is required from any property owners impacted by the backwater.
- Wetland Delineations: Wetland delineations shall be performed by a WDNR assured wetland delineator, a professional soil scientist, professional hydrologist or other

qualified individual approved by the administering authority. Delineations made by someone other than an assured delineator must receive WDNR concurrence. The individual performing the delineation shall classify the wetland as a less susceptible wetland, highly susceptible wetland, exceptional resource water or outstanding resource water.

- Disturbances: Protective areas may be disturbed as part of a project, if necessary. Disturbed areas must be stabilized from erosion and restored with a self-sustaining vegetation.
 - Type of Vegetation: It is recommended that seeding of non-invasive vegetative cover be used in the protective areas. Vegetation that is flood and drought tolerant and can provide long-term bank stability because of an extensive root system is preferable. Vegetative cover can be measured using the line transect method described in the University of Wisconsin Extension publication number A3533, titled "Estimating Residue Using the Line Transect Method".
 - Best Management Practices
 - BMPs may be located in protective areas (pond, swales, etc.)
 - Other state and local regulations may apply to BMPs located in protective areas and waters of the state, including the following:
 - Navigation, Dams and Bridges (Chapter 30 and 31, Wis. Stats.)
 - Wetland Water Quality Standards (NR 103)
 - Wetlands (US Army Corps of Engineers, Section 404 regulations)
 - Shoreland Management (NR 115, NR 117 and local regulations)
 - Floodplain Management (NR 116 and local regulations)
 - For purposes of S.07(3)(d)6d of the ordinance, a vegetated protective area to filter runoff pollutants from post-construction sites is not necessary, since runoff is not entering the surface water at that location. Other practices necessary to meet the requirements of this section, such as a swale or basin, will need to be designed and implemented to reduce runoff pollutants before the runoff enters a surface water of the state.
- (e) Fueling and Vehicle Maintenance Areas:
All post-construction sites are required to meet the ordinance's "no visible petroleum sheen" performance standard.
- **Design Clarifications:** The following BMPs are recommended to meet the performance standards contained within S.07(3)(e) of the ordinance:
 - Enclose vehicle maintenance areas in a building or under a roof.
 - Install a roof or canopy over fueling areas.
 - Divert runoff away from fueling and vehicle maintenance areas.
 - Keep adsorbent spill cleanup materials on-site at all times.
 - Install an oil/water separator and/or biofiltration device.
 - Install absorbent socks in catch basins, manholes or storm sewers downstream of areas receiving runoff from fueling and vehicle maintenance areas.
 - Post the spill response phone numbers in conspicuous on-site locations. The municipalities Illicit Discharge Ordinance requires reporting of hazardous spills. The

local municipality's spill response phone number is 911 and the WDNR's 24-hour spill response phone number is 1-800-943-0003.

(f) Swale Treatment for Transportation Facilities:

Post-construction sites with 20,000 ft² or more of impervious surface disturbance and post-construction sites with 1-acre or more of land disturbance are required to meet the ordinance's numeric performance standards. All other post-construction sites are not required to meet these numeric performance standards. BMP design guidance is provided below in S.07(3)(h) for sites with less than 20,000 ft² of impervious surface disturbance.

- **Design Clarifications:** For purposes of section S.07(3)(f)1a of the ordinance, it is preferred that tall and dense vegetation be maintained within the swale due to its greater effectiveness at enhancing runoff pollutant removal; however, the local municipality may have ordinances or other design criteria which dictate the allowable mowing height for grass swales.

For purposes of section S.07(3)(f)1b of the ordinance, check dams may be included in the swale design to slow runoff flows and improve pollutant removal. Transportation facilities with continuous features such as curb and gutter, sidewalks or parking lanes do not comply with the design requirements of S.07(3)(f)1b of the ordinance; however, a limited amount of structural measures such as curb and gutter may be allowed as necessary to account for other concerns such as human safety or resource protection.

For purposes of S.07(3)(f)2 of the ordinance, the WDNR's regional stormwater staff can determine if additional BMPs, beyond a water quality swale, are needed.

(g) Exemptions for S.07(3) Performance Standards

Projects that consist of only the construction of bicycle paths or pedestrian trails generally meet the exception found under S.07(3)(g)3d of the ordinance as these facilities have minimal connected imperviousness.

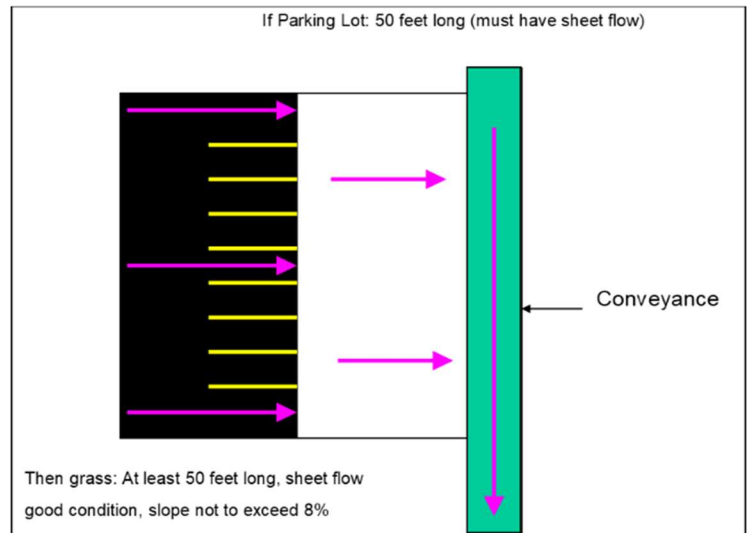
(h) Sites with Less than 20,000 ft² of Impervious Surface Disturbance

Pursuant to S.07(6) of the ordinance, the municipality may establish stormwater management requirements that are more stringent than those set forth in this section, if the municipality determines that an added level of protection is needed.

- **Design Clarifications:** For a post-construction site with less than 20,000 ft² of impervious surface disturbance, the applicant shall comply with the protective area requirements in S.07(3)(d) of the ordinance, the petroleum sheen requirements in S.07(3)(e) of the ordinance, and one of the two requirements provided below. It is recommended that the developer and designer contact the local municipality early in the design process to discuss which requirement must be complied with:
 1. Disconnect impervious surfaces. 90% or more of disturbed impervious surfaces must be disconnected. In order to consider an impervious surface as "disconnected", the following criteria shall be met:
 - Roofs: Discharge runoff over a minimum 20-foot long pervious surface that is in good condition and graded for sheet flow.

- Other Impervious Surfaces.
 - Source area flow length may not exceed 75-feet.
 - Source area **AND** pervious area must be graded for sheet flow.
 - Pervious area must be in good condition, have a slope less than 8% and have a flow length at least as long as the contributing impervious area's length (but never less than 20-feet).

Source: WDNR Post-Construction
Stormwater Management Workshops



2. Use the following best management practices and good housekeeping practices to reduce peak flow rates, improve water quality and encourage infiltration:
 - Vehicle and equipment maintenance shall be performed inside buildings, when feasible. Used fluids/batteries shall be stored and disposed of properly. Repair any vehicle leaks as soon as possible.
 - Outdoor trash bins are required for fast food restaurants, convenience stores and gas stations. Litter shall be cleaned up daily and disposed of properly.
 - Fertilizers shall be used sparingly for lawn areas. Fertilizers shall be immediately swept off streets, parking lots, driveways and sidewalks. Soil testing and compliance with WDNR Technical Standard 1100 (Turf Nutrient Management) is also encouraged.
 - Stream, shoreline, swale and other erosion problems shall be repaired as part of the development project, when feasible.
 - Roof downspouts, parking lots, driveways and sidewalks shall discharge stormwater runoff to lawn or other pervious areas, when feasible. Rain barrels are also encouraged at roof downspouts to store water for irrigation and watering landscaped areas (reduces municipal water invoice).
 - Create depressions in lawn areas and other landscape areas to temporarily store and treat stormwater runoff from roofs, parking lots, driveways and sidewalks, when feasible. Grass swales, biofiltration devices, bioretention devices and rain gardens are also encouraged, when feasible.
 - Filter baskets shall be installed in parking lot catch basins, when feasible.
 - Preserve wooded areas, trees, shrubs and other native vegetation that are in good condition, when feasible.

(i) Other Design Requirements

- Topographic surveys and plans shall be on 1988 North American Vertical Datum (NAVD88). Any historic data on different datum (i.e. floodplain mapping, etc.) shall be adjusted to NAVD88.
- Grass swales shall be designed with a minimum longitudinal slope of 1%.
- Storm sewers shall be designed for a 10-year design storm. A copy of storm sewer design calculations, time of concentration paths, tailwater conditions and watershed maps shall be submitted.
- Overland flow paths shall be designed for a 100-year design storm. Flow paths shall be provided for street low points and other depressions. The location of overland flow paths shall be shown on the plans. The maximum depth of ponding in street low points shall be 9-inches. The 9-inch depth is measured at the street centerline.
- Minimum finished ground elevations shall be provided for buildings, if deemed necessary, to provide reasonable flood protection. The minimum finished ground elevation shall be > 1-foot above the 100-year flood elevation and extend at least 15-feet beyond the building. Minimum elevations may need to be specified for lakes, rivers, streams, ponds and overland flow paths.
- A letter of permission may be required from downslope property owners if a post-development “point discharge” was “sheet flow” during the pre-development condition.
- The applicant may request a waiver or lesser design standard if site characteristics create a hardship.

Maximum Permissible Velocities for Channels			
Channel Cover	Slope Range %	Erosion-resistant soils	Easily eroded soils
Bermuda Grass	0-5	8 fps	6 fps
	5-10	7 fps	5 fps
	>10	6 fps	4 fps
Buffalo grass, Kentucky bluegrass, Smooth brome, blue grama	0-5	7 fps	5 fps
	5-10	6 fps	4 fps
	>10	5 fps	3 fps
Grass mixture	0-5	5 fps	4 fps
	5-10	4 fps	3 fps
	Do not use on slopes steeper than 10%, except for side slopes in a combination channel.		
Lespedeza sericea, weeping love grass Ischaemum (yellow bluestem), kudzu, alfalfa, crabgrass	0-5	3.5 fps	2.5 fps
	Do not use on slopes steeper than 5%, except for side slopes in a combination channel.		
Annuals – used on mild slopes or as temporary protection until permanent covers are established, common lespedeza, Sudan grass	0-5	3.5 fps	2.5 fps
	Use on slopes steeper than 5% is not recommended		

Source – Chow Open Channel Hydraulics

(4) GENERAL CONSIDERATIONS FOR ONSITE/OFFSITE STORMWATER MANAGEMENT MEASURES

(a) All proposed land development activities should be planned, designed and implemented as follows:

- In a manner that best fits the terrain of the site, avoiding steep slopes and other environmentally sensitive areas.
- According to the unique resource conditions at, around and downstream from a given site.
- According to the principles of Low Impact Development. Use source controls rather than end-of-pipe treatment. Reduce, prevent and mitigate the adverse impacts of development by maintaining infiltration, reducing frequency and volume of discharges, reducing peak flows and maintaining groundwater recharge. These goals can be accomplished by using:
 - Reduced impervious surfaces.
 - Functional grading to slow runoff and thereby lengthen the time of concentration.
 - Vegetated channels rather than paving or pipes.
 - Disconnection of impervious surfaces; drain to vegetated areas.
 - Bioretention (rain gardens, etc.) and infiltration (buffers, etc.) landscape areas.
 - Any other techniques that reduce the RCN or increase the time of concentration (T_c).
 - Use wet detention basins after all source area practices and techniques have been employed.

Overall, the goal is to design the site as an integral, living part of the environment with careful use of principles and practices that are both low-impact on runoff and simple for people to maintain and live with.

- To maintain groundwater recharge areas and the infiltration capacity of native soils by avoiding the unnecessary filling of large, natural depressions or compaction of upper soil horizons by construction equipment.
- To maintain soil infiltration by keeping all topsoil on-site.
- To provide the protective area, shoreland, wetland and environmentally sensitive area setback along all water courses.
- According to the sequence in the “Treatment Train”:
 - First do source controls:
 - Reduce impervious areas to maximum extent possible
 - Maintain undisturbed soil
 - Maintain existing trees, shrubs and vegetation
 - Next, do lot controls:
 - Grade lots to create long areas of overland flow rather than channels.
 - Minimize directly connected impervious areas by such practices as directing roof water to vegetated areas and draining driveways to grass rather than the street.
 - Include “rain gardens” (undrained areas that will pond water).
 - Then, do site controls:
 - Use grassed waterways and diversions rather than paved channels.
 - Maintain wetlands.
 - Use vegetated road ditches rather than curb and gutter.
 - Use wet detention basins. They can have pools 5 or more feet deep or may be designed as wetlands, but existing wetlands cannot be incorporated into stormwater facilities.

- Use off-line detention basins.
 - Finally, do regional controls such as regional detention basins.
- Area Trading: BMPs may be designed to treat runoff from existing developed areas in lieu of new development, redevelopment or routine maintenance areas with the approval of the administering authority.
- Phased Developments: Consider sizing/designing/building BMPs for future development phases during initial planning efforts.

(5) BMP LOCATION AND CREDIT

- (a) When using the regional treatment option, a letter is required from the owner of the regional facility. At a minimum, the letter shall state the following:
- Regional facility complies with ordinance requirements.
 - Site can use regional facility for ordinance compliance.
 - Maintenance agreement for regional facility has been recorded at the County Register of Deeds Office.

(6) TARGETED PERFORMANCE STANDARDS

(7) ALTERNATE REQUIREMENTS

(8) AGRICULTURAL PRODUCTION AREA STANDARDS

- (a) Agricultural Production Areas generally have large areas of impervious surfaces and are subject to large increases in impervious surfaces as farms expand; however, many Agricultural Production Areas have practices that capture and/or attenuate peak flows even though they are not typical stormwater management facilities. This section explains situations where credit can be given to those practices.
- (b) Thresholds of new impervious surface or rolling total of small additions of impervious surface added since the adoption of the current ordinance:
- < 20,000 ft²: Drainage plan, assessment of offsite impacts, explanation of mitigation.
 - > 20,000 ft² to 1-acre: All of the above, plus BMPs that attenuate peak flow as required [if peak flow requirements are not met, follow S.07(3)(b)].
 - > 1-acre: Bullet 1 (above) and engineered plan. Follow S.07(3)(b) Peak Discharge.
- (c) Source Areas that contribute to increases in peak flow rates:
- Feed Storage
 - Roofs
 - Driveways
 - Barnyards
 - Existing impervious surfaces
 - Calf housing/feeding areas
 - Contributing area to waste storage area (calf housing, sand storage, etc.)

Note: Crushed gravel, lime screening, paved surfaces and compacted soil are considered impervious.

(d) BMPs for Source Areas that commonly capture or mitigate stormwater runoff:

Note: Swales, infiltration trenches and ponds are not permitted BMPs from some surfaces (barnyards, feed storage, etc.) due to potential pollutant loading/significant discharge. Also see NR 151 for source area exemptions.

SOURCE AREAS				
BMP'S	Feed Storage Areas	Existing Impervious Surfaces	Barnyards	Driveways
	Pond	Pond	Pond	Pond
	Collection System (Waste Storage)	Collection System (Waste Storage)	Collection System (Waste Storage)	
	VTA (Vegetated Treatment Area)	VTA (Vegetated Treatment Area)	VTA (Vegetated Treatment Area)	
	Swale	Swale		Swale
	Infiltration Trench	Infiltration Trench		Infiltration Trench
	Ground Gutter	Ground Gutter		Ground Gutter
	Roof			
			Sediment Basin	

(e) Prescriptive Scenarios

- Some Agricultural Production Areas will not be at risk of discharging pollutants or high peak flows to surface waters due to their distance to any susceptible water body. If a site meets the following scenarios, it may be considered to meet the S.07 performance standards:
 - Impervious areas < 1-acre
 - Runoff flows onto a buffer, cropland or woodland
 - 100-feet of overland flow, or
 - 1,000-feet of channelized flow, or
 - Pro-rated combination of the above.
 - A farm owns at least 35-acres of contiguous undeveloped land in the same watershed.
 - Impervious surface is at least 300-feet from a navigable stream or wetland.
 - Impervious surface is at least 1000-feet from a lake, pond or karst feature.

(f) Prescriptive Source Areas

- On agricultural sites, some impervious surfaces drain to established facilities where they are treated or stored instead of running off of the site. In those situations, credit may be given to the area that discharges to another practice.
 - Waste Storage
 - For a waste storage facility located entirely within the sub-watershed nearby new impervious, the surface area of the waste storage and contributing areas is considered to meet S.07 performance standards.
 - For a waste storage facility located partially within the sub-watershed nearby new impervious, the surface area of the waste storage and contributing areas is considered to meet S.07 performance standards.
 - Barnyard
 - Barnyard all goes to waste storage facility that meets USDA/NRCS standards.
 - Feed Storage

- The portion of runoff from feed storage that is not leachate nor first flush that goes to a waste storage facility meeting USDA/NRCS standards is considered to meet S.07 performance standards.
- The portion of runoff from feed storage that goes to a NRCS 635 designed Vegetated Treatment Area (VTA) for treatment per NRCS 629 Waste Treatment is considered to meet S.07 performance standards.
- Other
Note: The remaining portion of runoff shall meet S.07 performance standards.
- Agricultural Buildings
 - Ground Gutters/French Drains
- Existing space between barns

S.08 PERMITTING REQUIREMENTS, PROCEDURES AND FEES

(1) PERMIT REQUIRED

(2) PERMIT APPLICATION AND FEES

(3) REVIEW AND APPROVAL OF PERMIT APPLICATION

(4) PERMIT REQUIREMENTS

- (a) The permit applicant is required to post the permit in a conspicuous place at the construction site.

- As-Built Drawings

- Post-construction sites with 20,000 ft² or more of impervious surface disturbance and post-construction sites with 1-acre or more of land disturbance are required to have as-built drawings. As-built drawings shall be signed by a licensed Professional Engineer. Agricultural land uses, unless they are exceptionally large or special in some other way, are not required to have as-built drawings. Typically, agricultural land uses will not need anything more than review and acceptance by the administering authority.
- Post-construction sites with less than 20,000 ft² of impervious surface disturbance are not typically required to have as-built drawings. Typically, sites with less than 20,000 ft² of impervious surface disturbance will not need anything more than review and acceptance by the administering authority.

(5) PERMIT CONDITIONS

(6) PERMIT DURATION

(7) ALTERNATE REQUIREMENTS

S.09 STORMWATER MANAGEMENT PLAN

(1) PLAN REQUIREMENTS

- (a) The stormwater management plan for post-construction sites with 20,000 ft² or more of impervious surface disturbance and post-construction sites with 1-acre or more of land disturbance shall contain, at a minimum, the following information:

- Name, address and telephone number for the following, or their designees:

- Landowner
- Developer
- Project Engineer for practice design and certification
- Person(s) responsible for installation of stormwater management practices
- Person(s) responsible for maintenance of stormwater management practices, prior to the transfer, if any, of the maintenance responsibility to another party.

- A proper legal description of the property proposed to be developed, referenced to the U.S. Public Land Survey System or to block and lot numbers within a recorded land subdivision plat.
- Pre-development site conditions, including:
 - One or more site maps, at a scale of not less than 1-inch equals 100-feet. The site maps shall show the following information:
 - Site location and legal property description
 - Predominant soil types and hydrologic soil groups
 - Existing cover type and condition
 - One or Two-foot topographic contours of the site
 - Topography and drainage network, including enough of the contiguous properties to show runoff patterns onto, through and from the site
 - Watercourses that may affect or are affected by runoff from the site
 - Flow path and direction for all stormwater conveyance sections
 - Watershed boundaries used in hydrology
 - Determinations to show compliance with performance standards
 - Lakes, streams, wetlands, channels, ditches and other watercourses on and immediately adjacent to the site
 - Limits of the 100-year floodplain
 - Location of wells and wellhead protection areas covering the project area and delineated pursuant to NR 811.12, Wis. Adm. Code.
 - Hydrology and pollutant loading computations as needed to show compliance with performance standards. All major assumptions used in developing input parameters shall be clearly stated. The geographic areas used in making the calculations shall be clearly cross-referenced to the required map(s).
- Post-development site conditions, including:
 - Explanation of the provisions to preserve and use natural topography and land cover features to minimize changes in peak flow runoff rates and volumes to surface waters and wetlands.
 - Explanation of any restrictions on stormwater management measures in the development area imposed by wellhead protection plans and ordinances.
 - Stormwater infiltration systems and ponds shall be located at least 400-feet from a well serving a community water system unless the WDNR and municipality concur that a lesser separation distance would provide adequate protection of a well from contamination.
 - Stormwater management practices shall be located with a minimum separation distance from any well serving a non-community or private water system as listed within NR 812.08
 - One or more site maps, at a scale of not less than 1-inch equals 100-feet, showing the following:
 - Post-construction pervious areas including vegetative cover type and condition
 - Impervious surfaces including all buildings, structures and pavement
 - Post-construction one or two-foot topographic contours of the site
 - Post-construction drainage network including enough of the contiguous properties to show runoff patterns onto, through and from the site

- Locations and dimensions of drainage easements
 - Locations of maintenance easements specified in the maintenance agreement
 - Flow path and direction for all stormwater conveyance sections
 - Location and type of all stormwater management conveyance and treatment practices, including the on-site and off-site tributary drainage area
 - Location and type of conveyance system that will carry runoff from the drainage and treatment practices to the nearest adequate outlet such as a curbed street, stormdrain or natural drainage way
 - Watershed boundaries used in hydrology and pollutant loading calculations and any changes to lakes, streams, wetlands, channels, ditches and other watercourses on and immediately adjacent to the site.
 - Hydrology and pollutant loading computations, as needed, to show compliance with performance standards. The computations shall be made for each discharge point in the development and the geographic areas used in making the calculations shall be clearly cross-referenced to the required map(s).
 - Results of investigations of soils and groundwater required for the placement and design of stormwater management measures. When permanent infiltration systems are used, appropriate on-site testing shall be conducted to determine if seasonal groundwater elevation or top of bedrock is within 5-feet of the proposed infiltration system. Detailed drawings, including cross-sections and profiles of all permanent stormwater conveyance and treatment practices.
- A description and installation schedule for the stormwater management practices needed to meet the performance standards in S.07.
 - A maintenance plan, developed for the life of each stormwater management practice, including the required maintenance activities and maintenance activity schedule.
 - Cost estimates for the construction, operation and maintenance of each stormwater management practice.
 - Other information requested in writing by the [administering authority] to determine compliance of the proposed stormwater management measures with the provisions of the ordinance.
 - All site investigations, plans, designs, computations and drawings shall be certified by a licensed Professional Engineer to be prepared in accordance with accepted engineering practice and requirements of the ordinance.

(2) ALTERNATE REQUIREMENTS

S.10 MAINTENANCE AGREEMENT

(1) MAINTENANCE AGREEMENT REQUIRED

- (a) Post-construction sites with 20,000 ft² or more of impervious surface disturbance and post construction sites with 1-acre or more of land disturbance are required to have a maintenance agreement. The applicant shall use the municipality's standard forms for the maintenance agreement. The local municipality is responsible for recording the signed maintenance agreement at the County Register of Deeds Office.
- (b) Post-construction sites with less than 20,000 ft² of impervious surface disturbance are not typically required to have a maintenance agreement
- (c) Sites utilizing the regional treatment option are not typically required to have a maintenance agreement; however, a maintenance agreement is required for the regional facility.

- (2) AGREEMENT PROVISIONS
- (3) ALTERNATE REQUIREMENTS

S.11 FINANCIAL GUARANTEE

(1) ESTABLISHMENT OF GUARANTEE

- (a) Post-construction sites with 20,000 ft² or more of impervious surface disturbance and post-construction sites with 1-acre or more of land disturbance are required to have a financial guarantee. The financial guarantee includes the cost associated with stormwater BMPs, as-built drawings, project administration and contingencies.
- (b) Post-construction sites with less than 20,000 ft² of impervious surface disturbance are not typically required to have a financial guarantee.
- (c) Sites utilizing the regional treatment option are not typically required to have a financial guarantee.

(2) CONDITIONS FOR RELEASE

- (a) The financial guarantee shall not be released until the applicant conducts a final inspection with a municipal representative, submits “as-built” drawings certified by a licensed Professional Engineer, completes punch list items and pays applicable fees.

(3) ALTERNATE REQUIREMENTS

S.12 FEE SCHEDULE

S.13 ENFORCEMENT

S.14 APPEALS

- (1) BOARD OF APPEALS OR ADJUSTMENT
- (2) WHO MAY APPEAL

S.15 SEVERABILITY

S.16 EFFECTIVE DATE