IOWA STORMWATER MANAGEMENT MANUAL

5.01 PRETREATMENT

IOWA DNR
IOWA DEPARTMENT OF NATURAL RESOURCES

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Refer to the glossary for words in **bold black text.**
Some items of emphasis are in **bold blue text.**

5.01-1 GENERAL INFORMATION

A. INTRODUCTION

Pretreatment practices are used to reduce maintenance and extend the lifespan of downstream water quality and quantity stormwater best management practices (BMPs) by removing trash, oil, grease, coarse sediments and other pollutants from stormwater inflows. **Collecting pollutants in a concentrated area simplifies maintenance, improves downstream water quality, and preserves the aesthetic appearance of downstream practices.** Pretreatment practices are essential to the sustainable performance of BMPs. While highly recommended upstream of all stormwater practices, they are especially important to be located upstream of infiltration-based practices.

B. OVERVIEW

PLANNING FOR PRETREATMENT

Pretreatment practices typically target the first flush of rainfall events. The sizing of pretreatment practices is different for various practices. Ideally, each stormwater BMP would be paired with an adequately sized and designed pretreatment practice and that practice would be maintained along a schedule which would sustain its ability to protect the downstream practice.

There should always be some level of pretreatment before stormwater water quality and quantity BMPs (especially important for infiltration based BMPs). If there is insufficient space to locate a properly sized pretreatment practice, it should be expected that the downstream BMP will need additional maintenance to remove debris and pollutants and more significant repairs and/or reconstruction are more likely to be needed.

With every project, the designer should plan out what types of pretreatment practices will be employed and where they will be located. **It is best to reserve the proper amount of space for the pretreatment practice and provide access routes for maintenance before other surrounding land uses are planned.**

A few notes when planning and designing pretreatment measures:

1. The study area should be divided into subareas expected to drain to expected **outflow points**, and eventually the areas expected to drain to each stormwater BMP.
2. Pretreatment practices should be sized based on the subwatershed area draining to it.
    a. Multiple pretreatment practices can be used in series to meet the pretreatment goal. Pretreatment requirements met by an initial practice can be carried over to the next practice downstream.
    b. Pretreatment practices can't be oversized to compensate for areas that won't have pretreatment.
    c. Areas that have already passed through a property sized pretreatment practice or water quality practice don't need to be pretreated again.
3. Properly designed pretreatment practices can be credited against Water Quality volume (WQv) requirements; however, **the credit for any pretreatment practice should not exceed 10% of the WQv volume passing through that practice.**

DOCUMENTATION

For each project, the pretreatment measures employed and the pretreatment volume they target should be quantified. This could be illustrated in a table, such as the example below:

Project example:

- Single-family residential subdivision
  - 60-acre development area
    - » 40 acres draining to "rear-yard" areas (35% impervious)
    - » 16 acres draining to "front-yard" and street ROW area (60% impervious)
    - » 4-acre "rear-yard" areas draining to stormwater wet pond (20% impervious)

Required Pretreatment:

ZONE	AREA	Rv	WQv	10% WQv
Rear Yards	40 acres	0.365	66,248 CF	6,625 CF
Front Yards	16 acres	0.590	42,834 CF	4,284 CF
Pond	4 acres	0.230	4,175 CF	418 CF

Pretreatment Summary:

ZONE	PRE-TREATMENT PRACTICE	PRETREATMENT REQUIRED	PRETREATMENT PROVIDED	% OF SUBAREA PRETREATMENT PROVIDED
Rear Yards	Vegetative Filter Strip	6,625 CF	1,700 CF	25%
Rear Yards	Grass Swales	6,625 CF	4,925 CF	75%
Front Yards	Forebay	4,284 CF	4,284 CF	100%
Pond	Vegetative Filter Strip	418 CF	418 CF	100%

In the project Stormwater Management Report, detailed calculations for each individual practice should be included in the appendix containing WQv calculaations.

C. APPLICATIONS FOR STORMWATER MANAGEMENT

USC Category	Pretreatment	Recharge Volume	Water Quality Volume	Channel Protection Volume	Overbank Flood Protection	Extreme Flood Protection
Practice						
Grass Swales	PY					
Vegetative Filter Strip	PY		*			
Sediment Forebay	PY					
Hydrodynamic Devices	PY		PO*			
Catch Basin Sumps and Inserts	PY					

PY = Primary Application, PO = Possible Application, Blank = Not Typically Applicable

* – Refer to the specific ISWMM section for more information about how these practices can be used towards meeting WQv treatment goals.

Pollutant Target	Total Suspended Solids (TTS)	Nitrogen	Phosphorus	Bacteria	Metals	Hydrocarbons
Practice						
Grass Swales	PY	PO			**	
Vegetative Filter Strip	PY	PO			**	
Sediment Forebay	PY		PO			
Hydrodynamic Devices	PY		PO		**	PO
Catch Basin Sumps and Inserts	PY		PO			

** – some reductions noted in 2020 International Stormwater BMP for certain metals, but not all types studied.

Source: The Water Research Foundation (2020), " International Stormwater BMP Database, 2020 Summary Statistics".

D. MAINTENANCE

The type and frequency of maintenance required should be considered by both the designer and the party responsible for maintenance when selecting a pretreatment practice. The required maintenance varies with the type and size of a practice, the anticipated pollutant load received by the practice, and the capability and availability of maintenance crews responsible for the practice.

Pre-treatment practices on the surface can be monitored by visual inspection. Forebays and filter strips may have more capacity to contain captured pollutants, which may mean they can be cleaned out less frequently. **Subsurface practices have less storage capacity and will need more frequent maintenance.** Since they are underground, they need to be opened and inspected to determine how quickly their storage capacity is filled.

When selecting proprietary products for pretreatment practices, manufacturers often provide maintenance guidelines; but these should always be applied in conjunction with relevant jurisdictional requirements and adjusted as needed after installation.

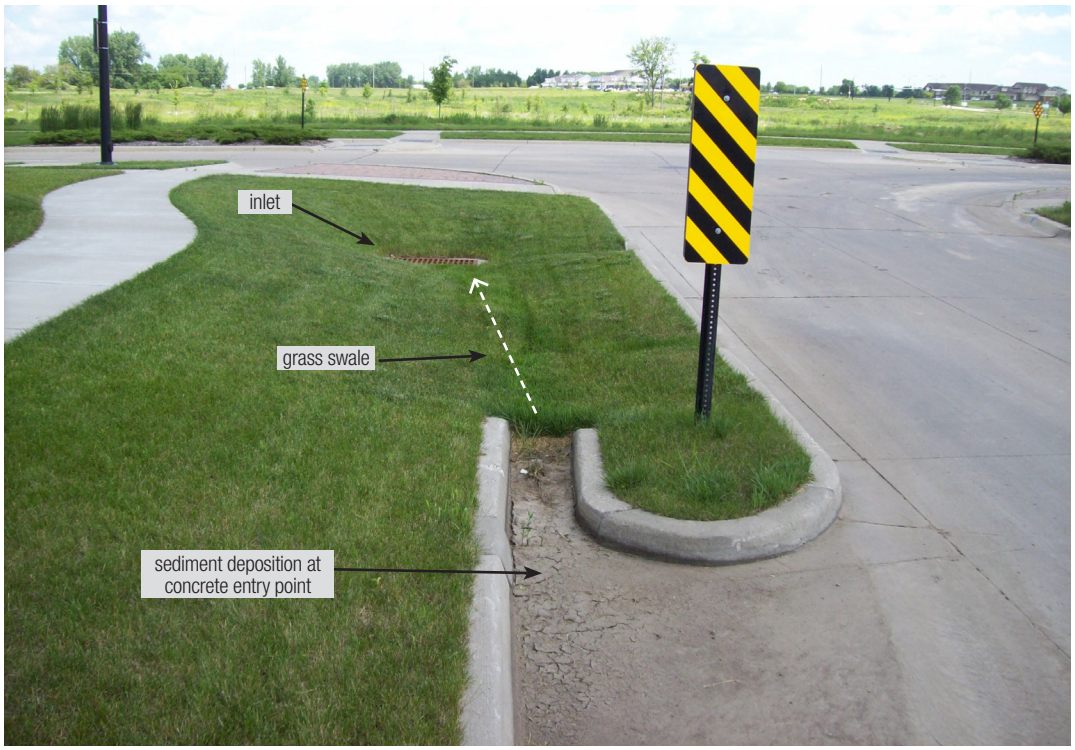
Debris removed from pretreatment practices with "typical" loading rates and pollutants can be disposed at a permitted landfill. However, conditions for disposal of debris and water in pretreatment practices may be subject to local authority and should be reviewed prior to the establishment of a routine maintenance plan.

For hot spot locations (fueling stations, industrial sites or other locations where chemical spills may be possible), the designer should think about including valves, **stop logs** or other systems which could be used to shut off flow or to prevent spills from entering a water quality or quantity BMP, storm sewer system or waterway.

5.01-2 PRETREATMENT OPTIONS

A. GRASS SWALES (SECTION 5.02)

Grass swales are open channels that convey stormwater and provide pretreatment. When these channels are designed to pass flow at low velocities, they can remove courser sediments and some pollutants through settling and biological uptake. Grass swales typically have gentle longitudinal slopes to promote slower flow velocities, with side slopes that are structurally stable and maintainable. This practice is most common in settings where open space is abundant. Runoff to be treated must pass along a minimum travel distance to be credited as a pretreatment practice.



Grass swale between curb cut and storm sewer inlet.

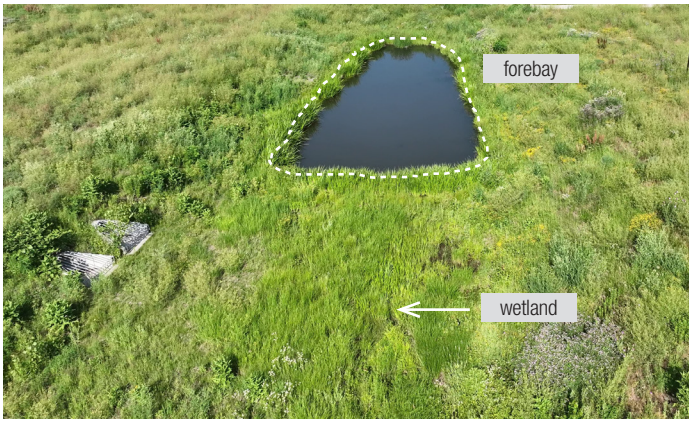
B. VEGETATIVE FILTER STRIP (SECTION 5.03)

Vegetative filter strips use sheet flow to reduce flow velocity, allowing heavier pollutants to settle out within the filter strip while increasing the potential for infiltration. These are best applied along smaller impervious areas where runoff can be spread uniformly across gentle slopes. They can also be applied along the shoreline of stormwater pond and constructed wetlands when concentrated flows are not expected.

Filter strip around a constructed stormwater wetland.

C. SEDIMENT FOREBAY (SECTION 5.04)

A sediment forebay is a smaller, shallow pool of water that precedes other larger surface stormwater practices like dry detention ponds, constructed wetlands, wet ponds, or bioretention. The purpose of a sediment forebay is to collect and settle heavier sediments in an easily maintained location; thereby improving water quality and reducing maintenance requirements in downstream practices. Inflows and outflows to the practice are typically concentrated through stormwater pipes or over reinforced spillways.



Example of a forebay.

D. HYDRODYNAMIC DEVICES (SECTION 5.05)

Hydrodynamic devices are typically proprietary products that are manufactured and transported to the site for installation. They vary in size depending on the rate of flow to be treated. These devices can remove coarse sediments (coarse silts, fine sands, and larger particles), debris, oils and greases from stormwater by passing flow through different chambers. Some chambers skim off floatable debris, oils and grease; while others promote circular flows to cause heavier sediments to settle out in the lower velocity zones within the chamber.

The internal components of these devices typically fit within circular storm structures. Many options may be used to provide pretreatment. These structures typically have limited storage capacity, so they will need to be monitored and cleaned frequently after installation. The results of initial maintenance can be used to determine how frequently they will need to be maintained over the long term. Without routine maintenance, the collection spaces within these structures will fill up, severely limiting their effectiveness in capturing additional pollutant material.

Some of these devices have been tested and shown to be able to remove at least 80% TSS at certain flow rates. Systems that meet certain testing standards can be used to meet WQv requirements, provided that the flowrate through the system during the WQv event is not expected to exceed the tested rate.

Typically, the flow rates these systems are able to treat are low, so that may prove to be a limitation on the size of the area they can effectively be used to treat. In some cases, the storm sewer network into these systems will need to include methods to allow higher flow rates from larger storm events to bypass these structures due to capacity limitations and to prevent resuspension of collected materials.

Installation of a hydrodynamic separator.

NOTE

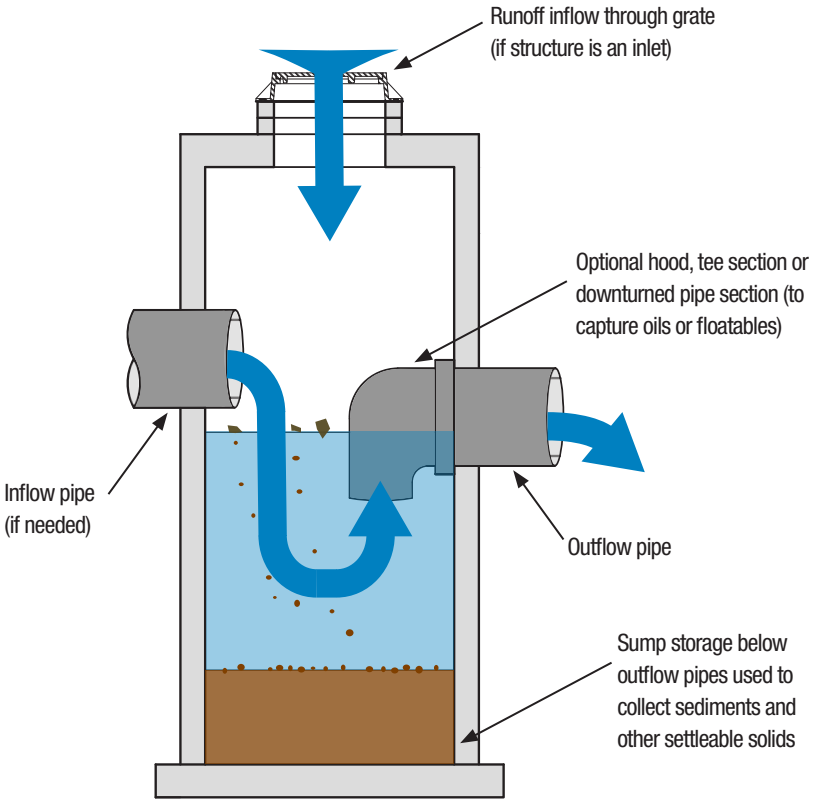
See Section 5.05 for more information on how hydrodynamic devices can be used to meet WQv requirements.

E. CATCH BASIN SUMPS AND INSERTS (SECTION 5.06)

Catch basin sumps and inserts are settling and filtering practices typically placed at the inlet of a storm sewer system to collect pollutants such as trash, oil/grease, and coarse sediments. Sumps are created when the bottom of a storm structure is constructed lower than the outlet pipe elevation. The sump volume below the outflow pipe will remain full of water between storm events, allowing heavier sediment materials to settle out of stormwater flows. Stormwater inserts are typically proprietary products which can be installed inside structures to restrict flows and promote additional settlement or debris capture.

A storm inlet designed as a catch basin sump in LaCrosse, WI.

Some can be inserted into existing storm sewer structures. Different variations of products are available depending on primary pollutants of concern. Like hydrodynamic devices, these practices are suitable where surface area is limited, and their performance is contingent upon frequent maintenance and cleaning.



An illustration of a catch basin sump structure.

5.01-3 GLOSSARY

Pretreatment: Employing features or practices used to capture the heaviest sediment or pollutant loads in an area upstream of a water quality BMP, preferably in a location where pollutants can be collected and removed easily.

Outflow points: The location where stormwater runoff will leave the boundary of a specific project site or study area.

Stop logs: Removable panels or gates within a storm structure, typically used to block flow and/or to adjust the water level maintained upstream of the stop logs (when installed).

5.01-4 REFERENCES

Clay, Jane et al. (2020) "International Stormwater BMP Database: 2020 Summary Statistics". The Water Research Foundation.