IOWA STORMWATER MANAGEMENT MANUAL

5.06 CATCH BASIN SUMPS AND INSERTS

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.**

5.06-1 LAYOUT AND DESIGN

A. SUMMARY

Storm intake structures can be designed with features to act as **pretreatment** devices. Different designs can improve the capture of heavier sediments, debris and/or oils. In such cases, the inlet would be designed with a "sump" set lower than the outflow elevation. Water will pool in the bottom of the intake allowing sediments and other debris to settle out. Other inserts can be included that may enhance the capture of other pollutant types.

The purpose of these types of structures is to capture coarse sediments, debris and oils in a confined location where they can be collected and removed. This reduces the total load being delivered to downstream stormwater best management practices (BMPs), improving their performance and longevity.

DESIGN PROCESS OVERVIEW

1. Complete Site Evaluation and Planning
2. Divide Site Into Watershed Subareas and Identify Locations for BMPs
3. Locate Pretreatment Practices
4. Develop Maintenance Plan
5. Integrate into Stormwater Plan

MAINTENANCE REQUIREMENTS

1. Designate Responsible Parties for Maintenance
2. Complete Construction Sequencing
3. Remove Accumulated Sediment and Debris Frequently from Pretreatment Area
4. Perform Regularly Occurring Maintenance

Catch basin sump installed in La Crosse, Wisconsin.

B. APPLICATIONS

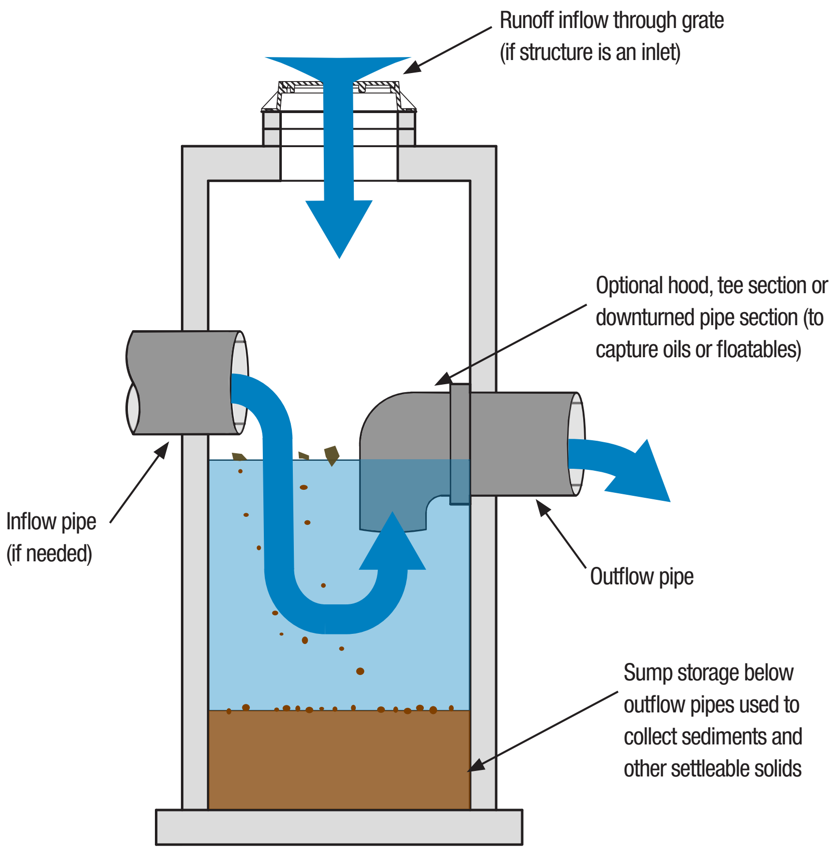
Catch basin sumps and inserts have limited capacity making them best suited for pretreatment for smaller watershed areas. They are best applied in locations where other pretreatment practices are less feasible because of available space or site features.

However, they also can be used in series with other pretreatment practices to target different types of pollutants. For example, certain designs could focus on catching floatable trash or oils at the catch basin, while a downstream forebay is used to provide additional pretreatment to capture smaller sediment particles.

Catch basin sumps are sometimes used as pretreatment upstream of tree trenches, planter boxes or bioretention cells. They can be more effective at these locations because those practice types often treat smaller watershed areas. In these locations, these pretreatment devices can extend the infiltration capacity of these BMPs by preventing heavier sediment loads from clogging the surface or burying installed plant materials with sediment.

Catch basin sumps and inserts may be less effective at protecting BMPs that manage runoff from larger watershed areas, such as dry detention basins, wet ponds and stormwater wetlands. However, they could be applied if multiple catch basins are used to treat smaller parts of the watershed. For example, if dozens of catch basin sumps were distributed throughout a commercial district, they may have a better ability to capture trash, sediments or oils from the smaller areas that would drain to each catch basin.

The sump inlet(s) should be placed in locations that are accessible by maintenance equipment. **A maintenance plan and schedule will need to be closely observed,** since these structures collect debris and sediments below ground. If they aren't maintained effectively, they will fill up and won't have the ability to continue to provide adequate pretreatment until cleaned out.



C. UNIFIED SIZING CRITERIA

Catch basin sumps and inserts are only to be used as pretreatment devices. They will not have significant capacity to address either the small or large storm elements of the **Unified Sizing Criteria.**

The pretreatment volume provided in the sump can be credited toward the **Water Quality volume** (WQv) requirements for areas draining to the sump, which are not already satisfied by another pretreatment or water quality BMP. The credit toward WQv would be equal to the pretreatment volume provided but should not exceed a credit of 10% of the previously unmanaged WQv passing through the catch basin sump device. ESSENTIAL

NOTE

See ISWMM Section 3.01 for more information about the Unified Sizing Criteria (USC).

D. DESIGN ELEMENTS AND CRITERIA

ACCESS

There needs to be a clear path with legal right of access to allow the party responsible for maintenance to reach the catch basin location. ESSENTIAL

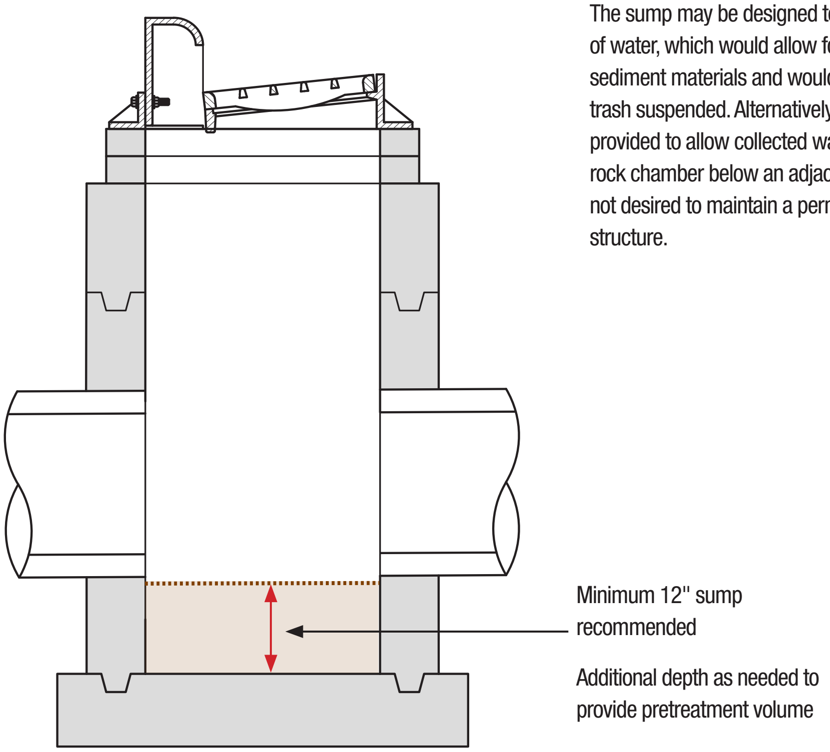
In many locations, this access can come from adjacent drives, parking stalls or streets.

The lid opening of the structure should be large enough to provide access if people are going to get down into the structure for maintenance. Personnel entering the below ground part of the structure are typically required to be certified through confined space training.

CONDITION AND DEPTH

The depth of the sump (measured below the downstream outlet elevation) will be as needed to provide the desired pretreatment volume. However, a minimum sump depth of 12 inches is recommended. TARGET

The sump may be designed to maintain a permanent pool of water, which would allow for settlement of suspended sediment materials and would keep floatable oils and trash suspended. Alternatively, small weep holes could be provided to allow collected water to slowly infiltrate into a rock chamber below an adjacent stormwater BMP, if it is not desired to maintain a permanent pool within the intake structure.



NOTE

Refer to Part 5.06-4 for more information about maintenance if covers, baffles and screens are used.

STORAGE

For catch basin sumps located upstream of stormwater dry and wet basins and stormwater wetlands, the sump should be sized to provide at least 10% of the calculated water quality volume that is not already provided by other upstream pretreatment practices or water quality BMPs. TARGET

For catch basins sumps that are being used to provide pretreatment for smaller infiltration based BMPs, such as bioretention cells, tree trenches or stormwater planter boxes, the sump should be sized to provide at least 5% of the calculated water quality volume that is not already provided by other upstream pretreatment practices or water quality BMPs. TARGET

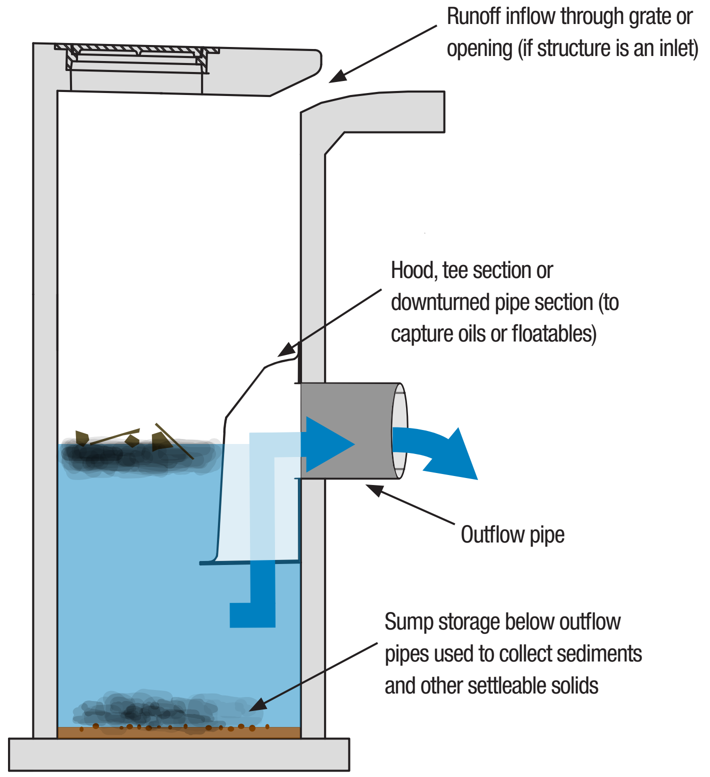
SHAPE

Sump structures can be any shape. Rectangular or circular are expected to be commonly used.

OUTLET COVERS, BAFFLES AND SCREENS

The catch basin may feature covers, baffles or screens placed around or over the outlet pipe to improve pollutant capture. These may be custom designed or premanufactured products. These may include, but are not limited to, the following:

- A downturned pipe or hood placed over the downstream pipe opening used to keep oils and floating debris suspended on top of the water trapped in the sump.
- A trash screen placed over the downstream pipe opening to keep larger trash or debris within the catch basin. When used, the designer should consider the expected frequency of maintenance and the potential for clogging the screen openings when selecting or designing the screen.



INTAKE INSERTS

There are some manufactured screens or bag inserts that can be placed below the grate of the catch basin which are intended to improve capture of sediments and debris. These are typically located within the structure below the grate, positioned to capture most of the flow dropping through the grate.

They should include a method to allow overflow into the catch basin below, should the flow into the inlet exceed the capacity of the screen or bag, or if the screen or bag were full of sediment and debris. ESSENTIAL

When used, intake inserts should be sized and designed following the manufacturer's specifications. Keep in mind that inserts can only provide pretreatment for flows that are actually directed to them from the surface. ESSENTIAL

One type of intake insert device. (Source: Fabco Industries website.)

E. SPECIAL CASE ADAPTATIONS

Catch basin sumps can be applied in retrofit applications where a sump structure is placed along an existing storm sewer line.

5.06-2 SIZING CALCULATIONS

A. CALCULATION PROCEDURE

1. **Determine the watershed area that the catch basin sump is providing pretreatment for.** Assess the parameters of that area, including total area, impervious cover, soil type and level of **soil quality restoration** (or existing soil quality).
2. **Calculate the Water Quality volume (WQv) parameters.**
   A. Determine the Water Quality volume to be treated.
   B. Calculate the pretreatment volume recommended to be provided by the sump structure.
3. **Select the size and depth of the sump structure to provide that volume.**
4. **Select any outlet covers, baffles, screens or inserts as desired to improve capture of pollutants or debris.** Refer to manufacturer's guidelines for design of those systems.
5. **Check that the peak flow of the design storm event (5- or 10-year storm, for example) for the intake structure can pass through the inlet structure,** accounting for the effects of any outlet covers, baffles, screens or inserts. A clogging factor of 50% is recommended to be used when any covers, baffles or screens are placed over the outfall pipe, unless the manufacturer's guidelines recommend a more restrictive clogging factor.

NOTE

No sizing procedure is provided for catch basin inserts, as those will depend on the manufacturer's requirements.

NOTE

Areas with less than 4" of topsoil or equivalent soil quality restoration (SQR) are considered 50% impervious for the purposes of calculating WQv requirements.

Refer to the Soil Quality Management and Restoration section of ISWMM for more information.

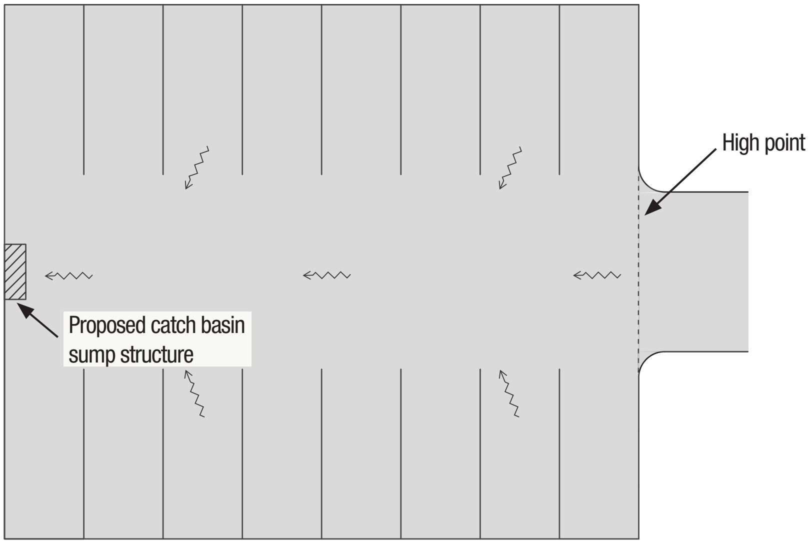
B. DESIGN EXAMPLES

For this example, it is given that part of a parking lot will drain to a catch basin sump structure for pretreatment upstream of a stormwater wetland.

1. Determine the watershed area that the catch basin sump is providing pretreatment for. Assess the parameters of that area, including total area, impervious cover, soil type and level of soil quality restoration (or existing soil quality).

For this example, it is given that the watershed to the inlet has the following parameters:

- Area = 0.10 acres
- **Impervious surfaces** = 0.10 acres (100%)
- **Time of concentration** (Tc) = 5 minutes
  - (given for this example, but should be calculated in practice)
- Soils:
  - **Hydrologic Soil Group** C
- **Curve Number** for larger storm events = 98



NOTE

As noted on page 4, 10% of WQv is recommended for pretreatment in a catch basin sump upstream of a detention basin or stormwater wetland.

NOTE

A 2 foot x 3 foot structure would be similar to a SUDAS type SW-501 inlet structure.

NOTE

A 4-foot diameter structure would be similar to a SUDAS type SW-401 manhole or SW-502 inlet structure.

2. Calculate the Water Quality volume (WQv) parameters. Determine the Water Quality volume to be treated.

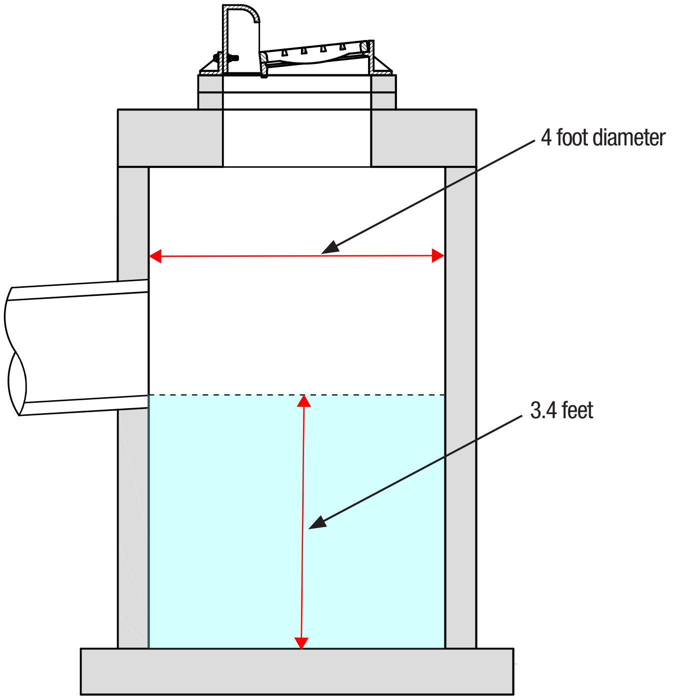
Water Quality volume calculations:

- Runoff coefficient (Rv) = 0.05 + 0.009 (I) I = impervious cover (%) **Equation 5.06-2-1**
  - Rv = 0.05 + 0.009 (100) = 0.950

- Water Quality volume (WQv) = Rv x P **Equation 5.06-2-2**
  - P = WQv precipitation (1.25 inches)
  - WQv = Rv x P = 0.950 x 1.25 inches = 1.1875 watershed-inches
    = 1.1875 watershed-inches x 0.10 acres x 43,560 (square feet / acre) / 12 (inches / foot)
    = 431 CF (cubic feet)

3. Select the size and depth of the sump structure to provide that volume.

- For this example, assume that 10% of the WQv is required for pretreatment.
  - Calculate 10% of the WQv:
    - » 431 cubic feet x 10% = 43.1 CF
  - If a 2 foot wide x 3 foot long storm intake structure were proposed, the depth of the sump would need to be at least:
    - » 43.1 CF / (2 feet x 3 feet) = 7.1 feet
    - » (This may not be practical – may need to use a larger structure to reduce sump depth).
  - If a 4-foot diameter circular structure were proposed, the depth of the sump would need to be at least:
    - » 43.1 CF / [π x (2 feet)^2] = 43.1 cubic feet / [12.57 square feet] = 3.4 feet



4. Select any outlet covers, baffles, screens or inserts as desired to improve capture of pollutants or debris. Refer to manufacturer's guidelines for design of those systems.

   No example provided. Refer to manufacturer's information and provide supporting documentation of calculations, as applicable.

5. Check that the peak flow of the design storm event (5- or 10-year storm, for example) for the intake structure can pass through the inlet structure, accounting for the effects of any outlet covers, baffles, screens or inserts. A clogging factor of 50% is recommended to be used when any covers, baffles or screens are placed over the outfall pipe, unless the manufacturer's guidelines recommend a more restrictive clogging factor.

   Assume the site is in West Central Iowa (Use rainfall values from Iowa Section 4 from the Rainfall and Runoff section of either SUDAS or ISWMM). Assume the local jurisdiction requires the storm network to be sized to convey the 10-year storm event.

- For a site with a time of concentration of 5 minutes, the 10-year storm rainfall intensity to be used for the rational method would be 7.88 inches per hour.
- For a 100% impervious watershed to the inlet, the runoff coefficient (C) to use for the rational method would be 0.95 (as per SUDAS, Section 2B-4).
- The rational method formula is:
- Q = C x I x A
  - Q = peak flow rate (cfs)
  - C = runoff coefficient
  - I = rainfall intensity (inches / hour)
  - A = area (acres)
- Q = 0.95 x 7.88 inches per hour x 0.10 acres
- Q = 0.75 cfs

To account for a 50% clogging factor, the opening on the cover, baffle, screen or insert would need to be sized to allow the following flow to pass:

- $Q_{adjusted}$ = Q / 50% = 0.75 cfs / 50% = 1.50 cfs

The opening sizes for the cover, baffle, screen or inserts could be checked using the orifice equation or other design information to determine if the outfall could pass the adjusted flow without causing water to build up to the surface within the catch basin.

NOTE

See the Rainfall and Runoff Section of ISWMM for design rainfall data.

5.06-3 CONSTRUCTION

A. POLLUTION PREVENTION

If the catch basin is part of a project whose total disturbed area exceeds one acre (including all parts of a common plan of development) a stormwater pollution prevention plan (SWPPP) is required by state and federal law to be prepared.

Prior to construction, coverage under the State of Iowa's NPDES General Permit No. 2 shall be obtained (or, if required, coverage through an individual permit).

The SWPPP document would need to meet state and local regulatory requirements and detail the structural and non-structural pollution prevention best management practices (BMPs) that are to be employed at the site.

EXTERIOR PROTECTION

All perimeter and site exit controls should be installed prior to any land-disturbing activities. Such controls may include (but are not limited to) site construction exits, perimeter sediment controls, construction limit fencing, waste collection, sanitary facilities and concrete washout containment systems.

INTERIOR PROTECTION

As construction activities begin, internal controls will be added to prevent erosion and sediment loss from the site area.

Erosion controls (mulches, rolled erosion control products, turf reinforcement mats, etc.) prevent detachment of soil particles from the surface.

Sediment controls (wattles, filter socks, silt fences, sediment basins, etc.) capture sediments after they have become suspended in runoff. Installation of controls may need to be staged to be implemented immediately after construction operations have ceased or are paused in a certain area.

For pollution prevention requirements for other stormwater best management practices associated with the project, refer to the relevant section of ISWMM for more pollution prevention information.

Construction of overflow flume from catch basin sump to planter boxes in La Crosse, Wisconsin.

B. CONSTRUCTION SEQUENCING

Catch basin sumps or inserts are typically designed to be constructed as part of a larger project. They typically will be installed along with the rest of the site storm sewer system.

Catch basin sumps are sized to capture sediment loadings from areas that are fully stabilized with permanent vegetation post-construction. During construction activities, sediment levels within incoming stormwater runoff will likely be elevated. This means sediment may need to be removed at various intervals during construction. **Near the end of project construction, any accumulated sediment should be removed from the catch basin sump.** This is so that it has its full capacity available as the project reaches the post-construction phase.

C. CONSTRUCTION OBSERVATION

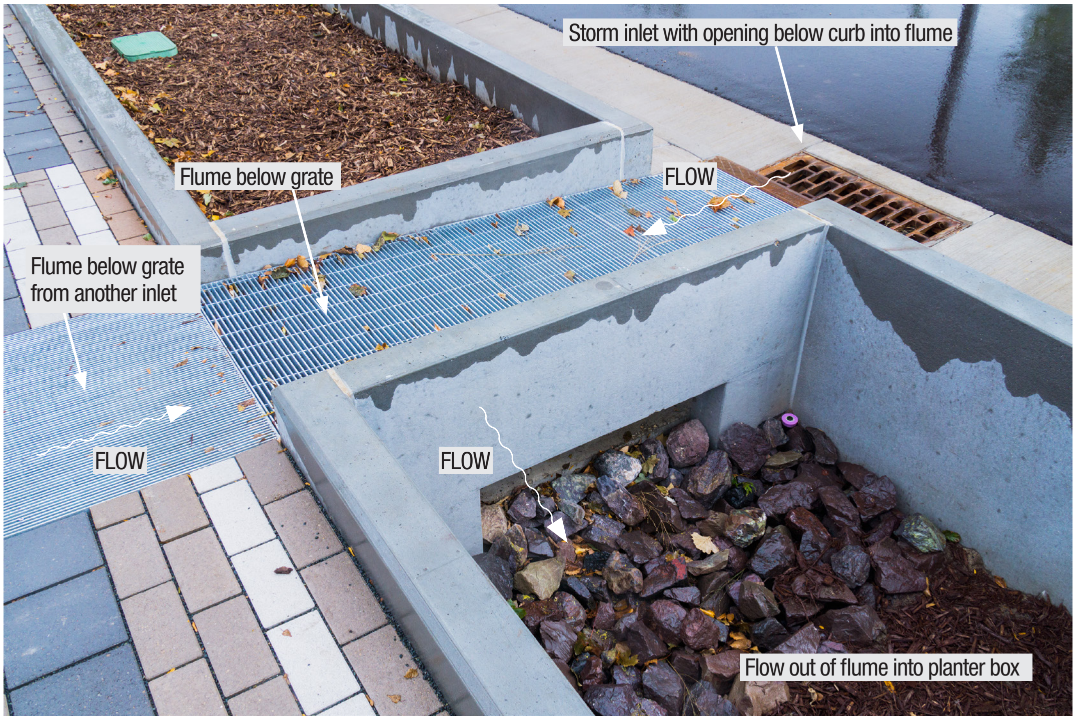
A designated representative of the owner should observe construction operations on a frequent basis to confirm the following:

- If the runoff is intended to be bypassed around the catch basin during construction, make sure the bypass pipes or channels are constructed as designed.
- Storm sewer and pipe structures leading to the catch basin are installed to the dimension, location and elevations specified on the plans and proper installation techniques and trench compaction techniques have been followed.
- The catch basin delivered to the site is the proper size and design as per the plans.
- The catch basin is installed to the location and elevation specified on the plans.
- Verify that any covers, baffles, screens or inserts are in compliance with the design included in the contract documents.
- Evaluate the condition of the catch basin to make sure there are not any cracks or other defects present that might occur prior to or after installation.
- Complete a walk-through with the designer and contractor to identify any items which are not in compliance with project requirements. Document issues in a punch list and confirm when all items are installed or repaired.
- Verify that accumulated sediment or debris is removed from the catch basin sump prior to final acceptance of the installation.
- As needed by the local jurisdiction, author a letter of acceptance noting either conformance with construction documents, or any allowed deviation thereof.

D. AS-BUILT REQUIREMENTS

During construction, records should be kept by the contractor (and site observer) that will allow record drawings of as-built improvements to be provided to the owner. To demonstrate that the project has complied with contract documents, these records should include, but not be limited to, the following:

- Locate the position and elevation of the rim or lid of the catch basin sump.
- Document the flowline elevation of each pipe entering or leaving the catch basin sump structure.
- Document the bottom elevation of the sump.
- Verify that any catch basin inserts match the specifications and material requirements as listed in the contact documents. Make sure that inserts are installed at the correct elevation or position within the structure. If they include a method for large storm overflow, make sure that feature is open and unobstructed after installation.



Overflow flume from catch basin sump covered with grate, just before installation of plant materials in La Crosse, Wisconsin.

5.06-4 MAINTENANCE

ACCESS PATH

Make sure that a path is kept clear to allow the required maintenance vehicles (usually a vacuum truck) to access the catch basin.

ACTIVITIES

During the design process, the entity responsible for routine and long-term maintenance should be identified. These tasks (such as those listed below) are necessary to maintain the function of the filter or catch basin sump structure. The capacity of the filter or catch basin sump to intercept suspended sediments and other debris will be reduced if these tasks are not completed. This could require additional or more frequent maintenance or repairs of downstream BMPs to maintain their function. ESSENTIAL

Table 5.06-4-1

Activity	Schedule
During construction (as applicable)	
Diversion reconnection after construction (if used to bypass practices during construction)	
Throughout construction, remove accumulated sediment within the sump collection area.	As needed, or at least when 50% of the sediment collection capacity if filled and at completion of major construction activities.
Delay installation of permanent (post-construction pretreatment) filters until upstream areas are stabilized with permanent vegetation.	As noted.
Post-construction	
Inspect the sediment collection areas.	At least four times the first year, and at least twice annually after that, but more frequently as needed if sediment buildup is often observed.
Inspect any covers, baffles or screens for debris or obstructions.	During each scheduled inspection.
Remove sediment from the collection area.	When 50% of the sediment collection capacity is filled. Typically, it would be expected that sediment may need to be removed from sump collection area at least once or twice each year.
Clean and remove debris as necessary.	When observed.
Follow any other manufacturer's recommendations.	As applicable.

- Sediments excavated from the catch basin sump that do not receive runoff from designated **hotspots** are not currently considered toxic or hazardous material and can be safely disposed of by either land application or at a permitted landfill. However, guidance related to handling Per- and Polyfluoroalkyl Substances (PFAS), sometimes referred to as "forever chemicals" is evolving. This guidance may need to be addressed as more federal or state guidance on PFAS is created.
- Sediment testing may be required prior to sediment disposal when a hotspot land use is present.
- Sediment removed from catch basin sumps during construction should be disposed of according to an approved SWPPP.

5.06-5 SIGNAGE RECOMMENDATIONS

Signage for pretreatment areas is not required, as it is less commonly used than at stormwater quality BMPs. However, signage could be provided as an educational tool to detail the purpose and function of the filter or catch basin sump structure to the general public. Signage can also be used to advise maintenance staff on maintenance requirements.

Illustration of an educational sign.

5.06-6 GLOSSARY

Best Management Practice (BMP)	A feature designed to meet stormwater water quality or quantity management goals.
Curve Number	A parameter used in NRCS Technical Release 20 or 55 (TR-20 or TR-55) that is used to estimate the rate and volume of stormwater runoff that will be created from rainfall, based on the soil types and land uses at a given location. Values range from around 30 to 100, with higher values resulting in more runoff being predicted from the equations used by TR-20 and TR-55 methods. See the NRCS TR-55 Methodology section of ISWMM for more information.
Hotspot	Land uses or activities that have the potential to generate higher pollutant loads than typical urban land uses. Gas stations and some industrial sites are examples of hotspots.
Hydrologic Soil Group (HSG)	Categories shown on County Soils Maps that describe the runoff potential of common soil groups. HSG categories range from A to D, with HSG A soils generating the least amount of runoff from rainfall events and HSG D soils generating the most.
Impervious surfaces	Surfaces on the landscape that do not allow water to pass through, such as roofs and paved surfaces.
Pretreatment	Use of practices or features to capture the heaviest sediment particles, trash or debris out of stormwater flows before it can enter a downstream BMP.
Time of concentration	The length of time it takes stormwater runoff to pass from the farthest upstream point in a drainage area to the outlet after runoff from rainfall has started.
Soil Quality Restoration (SQR)	Creating a healthy soil profile through methods of respreading topsoil materials or using blends of compost and sand to improve soil properties. (See the Soil Quality Management and Restoration Section of ISWMM.)
Unified Sizing Criteria (USC)	The set of stormwater management quality and quantity goals recommended by ISWMM.
Water Quality Volume (WQv)	One of ISWMM's USC, defined as the runoff generated by a 1.25-inch rainfall event. Over 90% of all rainfall events in Iowa are at or less than this amount of rain.

5.06-7 RESOURCES

"Best Management Practices to Maintain Catch Basins to Prevent Pollution", City of Portland, Oregon. https://www.portland.gov/bes/preventing-pollution/prevent-pollution/catch-basin-maintenance

Connecticut Stormwater Quality Manual, Connecticut Department of Energy & Environmental Protection. 2023.

Fabco Industries. https://fabco-industries.com/stormwater-catch-basin-filter-insert-basket/

"Stormwater Inlet Controls", Post Construction Stormwater Management in New Development and Redevelopment, Stormwater Best Management Practice. United States Environmental Protection Agency. December 2021.

"Water Quality Filters & Hydrodynamic Devices", BMP 6.6.4. Pennsylvania Stormwater Best Management Practices Manual. 2006.

5.06-8 APPENDIX

KEY DESIGN PARAMETER CHECKLIST

There are important aspects of this manual to consider when jurisdictions seek to create stormwater ordinances or policies that reference or adopt this manual. The Iowa Department of Natural Resources (IDNR) is responsible for the creation and maintenance of this manual, working with a technical committee of local volunteers. However, regulation and enforcement of post-construction stormwater management is primarily left to local jurisdictions.

Therefore, the IDNR does not enforce as requirements, the sizing and design criteria set for this document. For this reason, the language used within this manual has purposefully been written as a guideline, rather than a standard. This means certain language that conveys something is required (i.e. shall, must, etc.) is generally avoided. This has the potential to leave "gray areas" as to what may be interpreted to be required and what is recommended or optional, if this manual is adopted and referenced by local jurisdictions as a standard.

Throughout this section, different design parameters or considerations have been grouped into key categories:

ESSENTIAL

An element of the design of a BMP seen as critical to its proper performance, operation or aesthetics. **These aspects should be most important for inclusion and compliance and should rarely be deviated from.**

TARGET

An element of the design of a BMP seen as important to its proper performance, operation or aesthetics. **These aspects should be included in designs, if at all possible.** However, there is more flexibility to allow deviations if it can be demonstrated that it is infeasible to meet the requirement at a given location, or if a certain requirement is in conflict with other requirements. **Designers should explain any reason for deviation from targets, for the consideration of the jurisdiction as part of their review.**

IDEAL

An element of the design of a BMP seen as the recommended approach for its proper performance, operation or aesthetics. Designers are encouraged to include these in designs as best practice. However, these items are seen as less critical as those noted as essentials or targets.

CAUTION

These are notes or design guidance to highlight items for the designers' careful consideration.

ADVISORY

These are practices, techniques or potential deviations from the design ethic that should be avoided in most circumstances.

ESSENTIAL

1. The credit toward WQv from the pretreatment device can be equal to the pretreatment volume provided but should not exceed a credit of 10% of the previously unmanaged WQv passing through the catch basin sump device. (page 3)
2. There needs to be a clear path with legal right of access to allow the party responsible for maintenance to reach the catch basin location. (page 3)
3. When manufactured screens or bag inserts are used, they should include a method to allow overflow into the catch basin below, should the flow into the inlet exceed the capacity of the screen or bag, or if the screen or bag were full of sediment and debris. (page 5)
4. When used, intake inserts should be sized and designed following the manufacturer's specifications. Keep in mind that inserts can only provide pretreatment for flows that are actually directed to them from the surface. (page 5)
5. During the design process, the entity responsible for routine and long-term maintenance should be identified. A maintenance plan should be prepared for the proposed pretreatment practice. The maintenance tasks are necessary to maintain the function of the catch basin sump structure. (page 13)

TARGET

1. The depth of the sump (measured below the downstream outlet elevation) will be as needed to provide the desired pretreatment volume. (page 3)
2. A minimum sump depth of 12 inches is recommended. (page 3)
3. For catch basin sumps located upstream of stormwater dry and wet basins and stormwater wetlands, the sump should be sized to provide at least 10% of the calculated water quality volume that is not already provided by other upstream pretreatment practices or water quality BMPs. (page 4)
4. For catch basins sumps that are being used to provide pretreatment for smaller infiltration based BMPs, such as bioretention cells, tree trenches or stormwater planter boxes, the sump should be sized to provide at least 5% of the calculated water quality volume that is not already provided by other upstream pretreatment practices or water quality BMPs. (page 4)