Water Resources Division

Catch Basin

Definition

This best management practice (BMP) presents the recommended methods of planning, design, construction, and maintenance of the catch basin, which is a receptacle, reservoir, basin, or pit beneath a storm sewer opening, for collecting surface water drainage or runoff. A catch basin minimizes sewer clogging and provides some basic storm water pretreatment by trapping larger matter with an inlet grate, and by allowing sediment and other smaller material to settle in a sump located below the invert elevations of all outlet pipes. A leaching style catch basin has an open, pervious, stone-filled sump bottom, allowing water to infiltrate into the ground.

Description

Pollutant Controlled

Primarily coarse sediment—Particles of 0.04 inch (1 millimeter) diameter and larger—medium or coarse sand (depending on the soil classification system being used), gravel, etc.

Treatment Mechanisms

- Settling (in catch basin sump); and

- Infiltration (through pervious bottom of leaching basin type catch basin, described below)

Pollutant Removal Efficiency

In general, the more frequently catch basins are cleaned out, the better the pollutant removal efficiency. Studies indicate that a regularly cleaned out catch basin can achieve up to approximately 50 percent removal of coarse sediment, with lower removals for other parameters (total suspended solids, chemical oxygen demand, biochemical oxygen demand, nutrients, metals, etc.).

Companion & Alternate Practices

During the planning stage, prior to system design or construction, as an alternative to storm sewer, consider a Grassed Waterway, Stormwater Conveyance Channel, or other similar surface water conveyance that provides adequate flow capacity and storage, pollutant removal, safety, and flood minimization.

With an existing storm sewer system, consider pre-treating runoff entering the catch basin with catch basin treatment devices, or minimizing the amount of material flushed into catch basins by Street Sweeping.

Advantages & Disadvantages

One design guide (Stormwater Center, undated) identifies the following limitations of catch basins:

1. Even carefully designed catch basins cannot remove pollutants as well as other storm water treatment practices, such as wet ponds, sand filters, or storm water wetlands. Another alternative is green infrastructure as a means of minimizing the generation of storm water runoff.

2. Unless properly maintained, catch basins can become a source of pollutants through re-suspension (described in more detail in the maintenance section below); and

3. Catch basins cannot effectively remove soluble pollutants, or fine particles (fine sand, silt, clay, or colloids).

Location

Within storm sewer systems, catch basins are located at low points, and otherwise spaced to provide adequate drainage of surface water runoff.

Materials

Catch basins and sumps are typically constructed of precast concrete. Brick and concrete block are frequently seen in older systems. Inlet covers are made of cast iron.

Design

Refer to Figure 1 for a standard catch basin schematic, and Figures 2, 3, and 4 for three types of standard inlet grates.

Regarding catch basin sizing, one study (Lager et al, 1977) identifies the following optimal catch basin and sump dimensions, based on an outlet pipe of diameter 'D':

- Sump depth: At least 4D
- Catch basin diameter: 4D
- Catch basin overall depth: 6.5D
- Depth to top of outlet pipe: 1.5D

Refer to Figure 5 for a depiction of these dimensions.

Another design study (Pitt et al, 1997) suggests a catch basin sizing method in which the expected storm water runoff solids concentration is used to estimate the amount of solids that will be collected between sump clean-outs, applying a factor of safety, and sizing the catch basin accordingly.

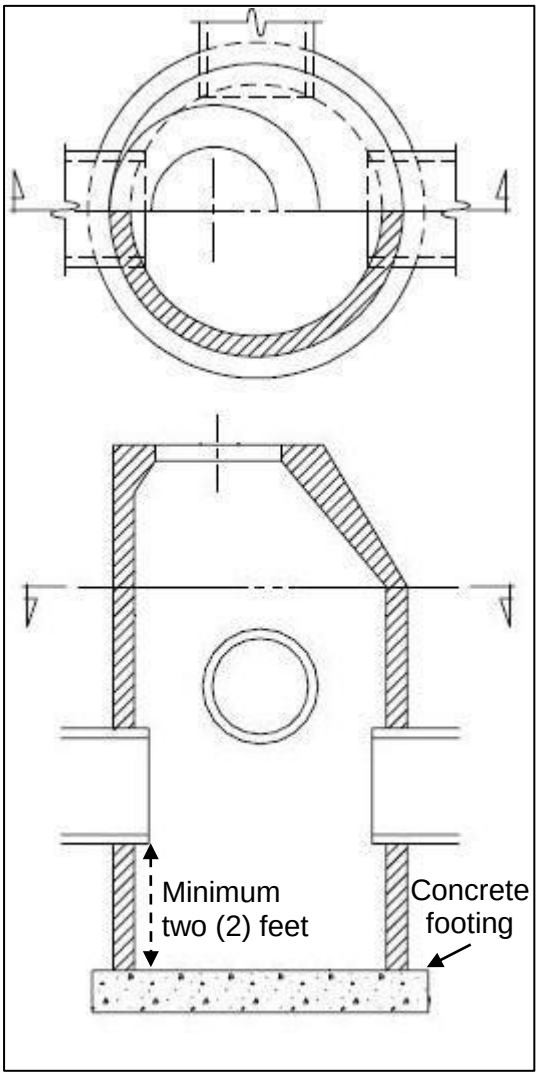


Figure 1. Standard Catch Basin with Sump
Source: Adapted from MDOT, 2001a.

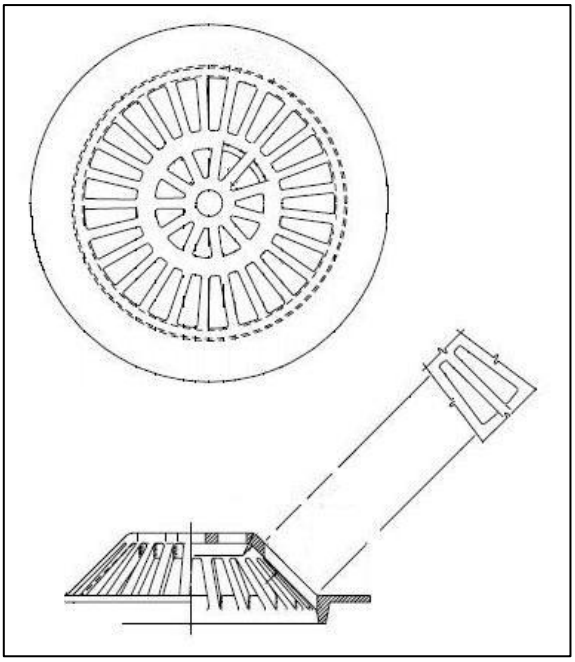


Figure 2. Inlet Grate Type 'E'
Source: Adapted from MDOT, 2004a.

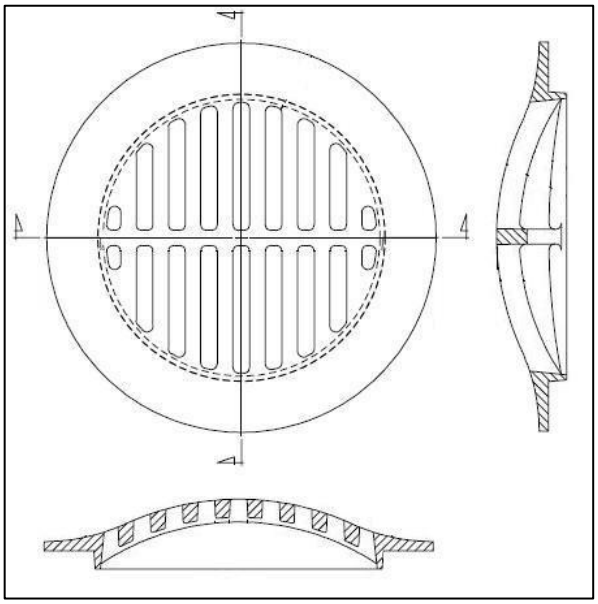


Figure 3. Inlet Grate Type 'G'
Source: Adapted from MDOT, 2004b.

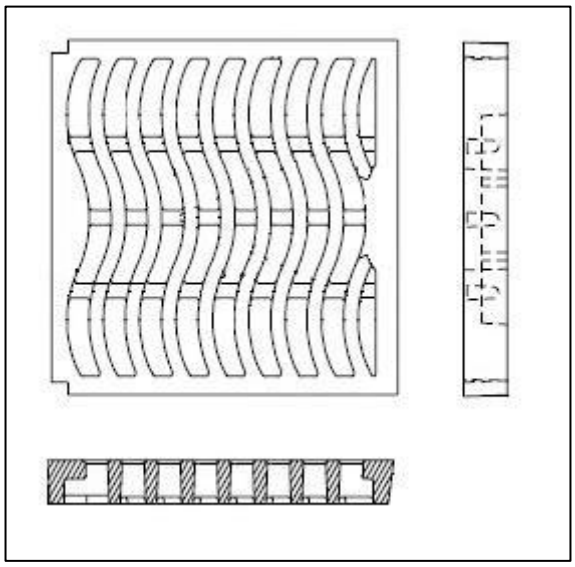


Figure 4. Inlet Grate Type 'R'
Source: Adapted from MDOT, 2004c.

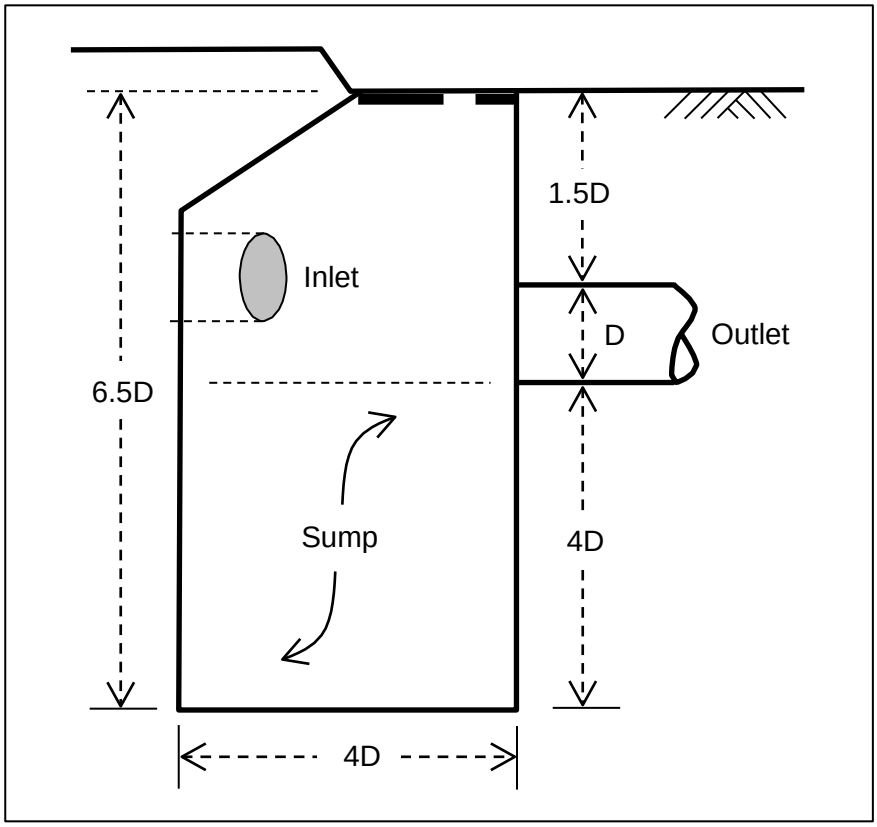


Figure 5. Optimal Catch Basin Dimensions
Source: Adapted from Lager et al, 1977.

Performance Enhancers

A hooded inlet can prevent floatable materials and trash from entering the storm drain system. An inclined screen mounted in front of catch basin inlet (whether hooded or standard) can help capture trash that has entered the catch basin from getting into the storm sewer system.

A leaching basin is similar to a standard catch basin, except that instead of a solid concrete base, the leaching basin bottom consists of loose aggregate, through which storm water flows, and infiltrates into the ground underneath. Refer to Figure 6 for a depiction of a leaching basin. Do not use leaching basins in areas where potential groundwater contamination is an issue, such as in wellhead protection areas. Also note that leaching basins are considered by the United States Environmental Protection Agency (USEPA) to be Class V injection wells, and therefore must be compliant with their requirements.

A sewer trap is an outlet pipe angled upward as it leaves the catch basin. It can prevent large solids from leaving the catch basin, act as an odor control device, and serve as an oil-water separator. It's similar in configuration and operation to a hooded outlet. Refer to Figure 7 for a standard sewer trap schematic.

Construction

Install Construction Barriers around the site to prevent pedestrian access.

Consider using Diversions or other soil erosion control practices up-slope of catch basins to prevent polluted runoff from entering the site. See the Storm Sewer Inlet Protection BMP for ways of preventing polluted runoff from entering the sewer. Post-construction maintenance may be necessary regardless of whether or not inlet protection was provided.

Stabilize the site following the Seeding, Mulching, and Sodding BMPs. Remove any temporary BMPs after vegetation has been established.

Maintenance

The preferred method of material removal from catch basins is using a sewer vacuum, referred to as a vactor truck.

Some references recommend catch basin cleaning when the sediment height in the sump gets up to 0.3 meters (one foot) below the outlet pipe invert. Other references recommend clean-out when the sediment depth reaches anywhere from 30 percent to 50 percent of total sump depth. Too-infrequent cleaning can result in sumps filling up to a point where any sediment entering catch basins simply passes on through the system. Sumps that are too full of material are also more prone, at lower flows, to re-suspension and passage of any previously settled material.

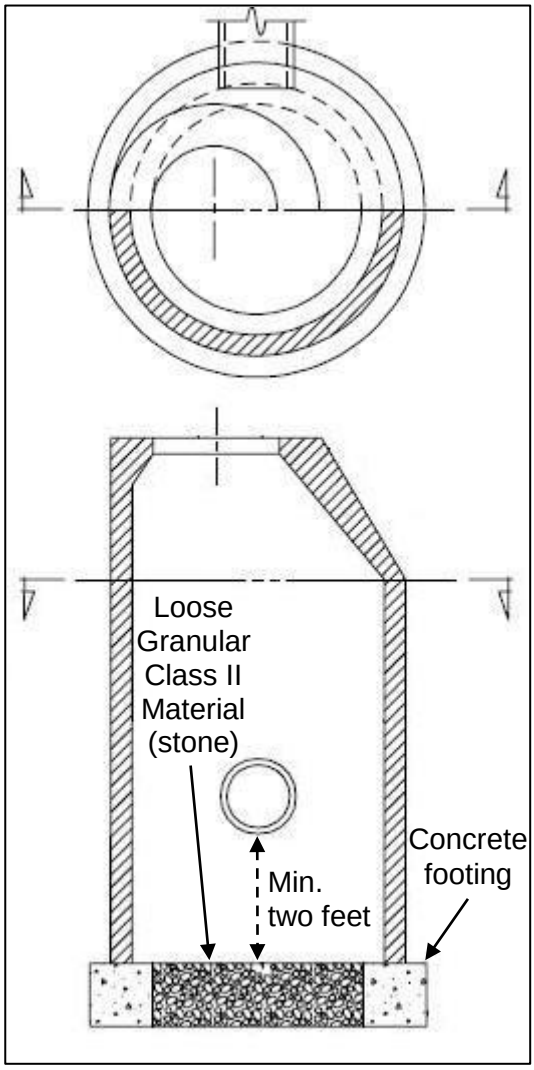


Figure 6. Leaching Basin
Source: Adapted from MDOT, 2001a.

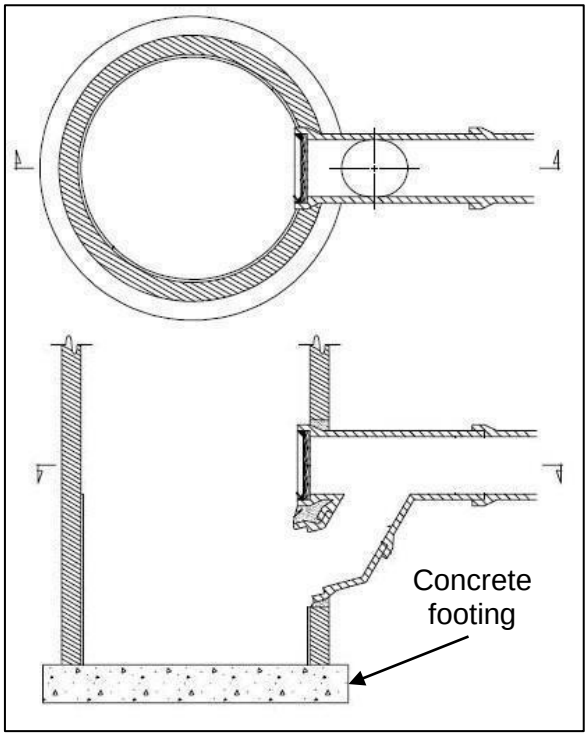


Figure 7. Sewer Trap
Source: Adapted from MDOT, 2001b.

One study (Herrera Environmental Consultants, Inc., 2006) suggests the following clean-out frequencies, based on the land use draining to a given catch basin:

- Industrial: quarterly to semi-annually

- Commercial: semi-annually

- Residential: annually

This study also states that, based on a review of previous monitoring studies, there is a point of diminishing returns. That is, above a certain clean-out frequency, no more water quality benefit is gained, because so little material has accumulated since the previous clean-out.

Therefore, the clean-out frequencies cited above should only be used as a guideline or a starting point. Rather than relying completely on arbitrary, fixed maintenance schedules, operators should monitor and track their storm sewer systems to determine how quickly catch basins sumps fill up. They should then base their clean-out frequency on that monitoring data, to maximize the amount of residue obtained, and water quality benefit provided.

The combined solid and liquid residue generated from cleaning out catch basins is legally defined as "liquid industrial waste" in Part 121, Liquid Industrial Wastes, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, (NREPA)and is subject to all the requirements of that legislation. Refer to MDEQ (2007) guidance for proper handling, transportation, and disposal of material generated by cleaning catch basins.

This publication is intended for guidance only and may be impacted by changes in legislation, rules, policies, and procedures adopted after the date of publication. Although this publication makes every effort to teach users how to meet applicable compliance obligations, use of this publication does not constitute the rendering of legal advice.

For information or assistance on this publication, please contact the Water Resources Division, Nonpoint Source Program, through the MDEQ Environmental Assistance Center at 800-662-9278. This publication is available in alternative formats upon request.

www.Michigan.gov/EGLE

References

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Lager, J.A., W.G. Smith, W.G. Lynard, R.M. Finn, and E.J. Finnemore. 1977. *Urban Stormwater Management and Technology: Update and Users Guide*. USEPA. EPA-600/8-77-014.

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