POLLUTION PREVENTION FACT SHEETS:
CATCH BASINS

Description

A catch basin (a.k.a., storm drain inlet, curb inlet) is an inlet to the storm drain system that typically includes a grate or curb inlet where stormwater enters the catch basin and a sump to capture sediment, debris and associated pollutants. They are also used in combined sewer watersheds to capture floatables and settle some solids. Catch basins act as pretreatment for other treatment practices by capturing large sediments. The performance of catch basins at removing sediment and other pollutants depends on the design of the catch basin (e.g., the size of the sump), and routine maintenance to retain the storage available in the sump to capture sediment.

Applicability

Catch basins are used in drainage systems throughout the United States. However, many catch basins are not designed for sediment and pollutant capture. Ideal application of catch basins is as pretreatment to another stormwater management practice. Retrofitting existing catch basins may help to improve their performance substantially. A simple retrofit option of catch basins is to ensure that all catch basins have a hooded outlet to prevent floatable materials, such as trash and debris, from entering the storm drain system.

Limitations

Catch basins have three major limitations, including:

- Even carefully designed catch basins cannot remove pollutants as well as stormwater treatment practices, such as wet ponds, sand filters, and stormwater wetlands.
- Unless frequently maintained, catch basins can become a source of pollutants through resuspension.
- Catch basins cannot effectively remove soluble pollutants or fine particles.

Siting and Design Considerations

The performance of catch basins is related to the volume in the sump (i.e., the storage in the catch basin below the outlet). Lager *et al.* (1977), described an "optimal" catch basin sizing criteria, which relates all catch basin dimensions to the diameter of the outlet pipe (D). Dimensions are:

- The diameter of the catch basin should be equal to 4D.
- The sump depth should be at least 4D. This depth should be increased if cleaning is infrequent or if the area draining to the catch basin has high sediment loads.
- The top of the outlet pipe should be 1.5 D from the inlet to the catch basin.

Catch basins can also be sized to accommodate the volume of sediment that enters the system. Pitt *et al*. (1997) proposed a sizing criteria based on the concentration of sediment in stormwater runoff. The catch basin sump is sized, with a factor of safety, to accommodate the annual sediment load to the catch basin with a factor of safety. This method is preferable where high sediment loads are anticipated, and the optimal design described above is suspected to provide little treatment.

The basic design should also incorporate a hooded outlet to prevent floatable materials and trash from entering the storm drain system. Adding a screen to the top of the catch basin would not likely improve the performance of catch basins for pollutant removal, but would help capture trash entering the catch basin (Pitt *et al*., 1997).

A variety of other products, known as "catch basin inserts," may also be used to filter runoff entering the catch basin. There are two basic types of catch basin inserts. One insert option consists of a series of trays, with the top tray serving as an initial sediment trap, and the underlying trays comprised of media filters. Another option uses filter fabric to remove pollutants from stormwater runoff. These devices have a very small volume compared to the volume of the catch basin sump, and would typically require very frequent sediment removal. Bench test studies found that a variety of products showed little removal of total suspended solids, partially due to scouring from relatively small (6-month) storm events (ICBIC, 1995).

One design adaption of the standard catch basin is to incorporate infiltration through the catch basin bottom. Two challenges are associated with this design. The first is the potential groundwater impacts, and the second is the potential for clogging, preventing infiltration. Infiltrating catch basins should not be used in commercial or industrial areas, due to possible groundwater contamination. While it is difficult to prevent clogging at the bottom of the catch basin, it may be possible to incorporate some pretreatment into the design.

Maintenance Considerations

Typical maintenance of catch basins includes trash removal if a screen or other debris capturing device is used, and removal of sediment using a vactor truck. Operators need to be properly trained in catch basin maintenance. Maintenance should include keeping a log of the amount of sediment collected, and the data of removal. Some cities have incorporated the use of GIS systems to track sediment collection, and to optimize future catch basin cleaning efforts.

One study (Pitt, 1985) concluded that catch basins can capture sediments up to approximately 60% of the sump volume. When sediment fills greater than 60% of their volume, catch basins reach steady state. Storm flows may then bypass treatment as well as resuspend sediments trapped in the catch basin. Frequent clean-out can retain the volume in the catch basin sump available for treatment of stormwater flows.

At a minimum, catch basins should be cleaned once or twice per year (Aronson *et al*, 1983). Two studies suggest that increasing the frequency of maintenance can improve the performance of catch basins, particularly in industrial or commercial areas. One study of sixty catch basins in Alameda County, California, found that increasing the maintenance frequency from once per year to twice per year could increase the total sediment removed by catch basins on an annual basis (Mineart and Singh, 1994). Annual sediment removed per inlet was 54 pounds for annual cleaning, 70 pounds for semi-annual and quarterly cleaning, and 160 pounds for monthly cleaning. For catch basins draining industrial uses, monthly cleaning increased total annual sediment collected to six times the amount collected by annual cleaning (180 lbs. versus 30 lbs.). These results suggest that, at least for industrial uses, more frequent cleaning of catch basins may improve removal efficiency. However, the cost of increased operation and maintenance costs needs to be weighed against the improved pollutant removal. For more information, see *The Value of More Frequent Cleanouts of Storm Drain Inlets*, Article 122 in The Practice of Watershed Protection.

In some regions, it may be difficult to find environmentally acceptable disposal methods. The sediments may not always be land-filled or land-applied due to hazardous waste, pretreatment or groundwater regulations. This is particularly true when catch basins drain runoff from hotspot areas.

Effectiveness

What is known about the effectiveness of catch basins is limited to a few studies. Table 1 outlines the results of some of these studies:

Table 1. Pollutant Removal Capability Of Catch Basins

Study	Notes	TSS	COD	BOD	TN	TP	Metals
Pitt *et al.*, 1997	-	32	-		-	-	-
Aronson *et al.*, 1983	Only very small storms were monitored in this study.	60-97	10-56	54-88	-	-	-
Pitt and Shawley, 1982	-	10-25	5-10	-	5-10 (TKN)	5-10	10-25 (Pb) 5-10 (Zn)
Mineart and Singh, 1994	Annual load reduction estimated based on concentrations and mass of catch basin sediment.	-	-	-	-	-	For Copper: 3-4* 15**

* Annual cleaning
** Monthly cleaning

Cost Considerations

A typical pre-cast catch basin costs approximately between $2,000 and $3,000. The true pollutant removal cost associated with catch basins, however, is the long-term maintenance cost. A vactor truck, the most common method of catch basin cleaning, costs between $125,000 and $150,000. This initial cost may be high for smaller communities, however, it may be possible to share a vactor truck with another community. Typical vactor trucks can store between 10 and 15 cubic yards of material, which is enough storage for between three and five catch basins with the "optimal" design and an 18" inflow pipe. Assuming semi-annual cleaning, and that the vactor truck could be filled and material disposed of twice in one day, one truck would be sufficient to clean between 750 and 1,000 catch basins. Another maintenance cost is the staff time needed to operate the truck. Depending on the rules within a community, disposal costs of the sediment captured in catch basins may be significant.

References

Aronson, G., D. Watson, and W. Pisaro. 1983. *Evaluation of Catch Basin Performance for Urban Stormwater Pollution Control*. EPA-600/2-83-043.

Interagency Catch Basin Insert Committee (ICBIC). 1995. *Evaluation of Commercially-Available Catch Basin Inserts for the Treatment of Stormwater Runoff from Developed Sites*. Seattle, WA.

Lager, J., W. Smith, R. Finn, and E. Finnemore. 1997. Urban Stormwater Management and Technology: *Update and Users' Guide*. US EPA. EPA-600/8-77-014. 313 pp.

Mineart, P. and S. Singh. 1994. *Storm Inlet Pilot Study*. Woodward-Clyde Consultants. Alameda County Urban Runoff Clean Water Program. Oakland, CA.

Pitt, R. 1985. *Bellevue Urban Runoff Project*. Final Report.

Pitt, R., M. Lilbum, S. Nix, S. Durrans, and S. Burian. 1997. *Guidance Manual for Integrated Wet Weather Flow Collection and Treatment Systems for Newly Urbanized Areas*. US EPA. Office of Research and Development. Cincinnati, OH.