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The Value of More Frequent Cleanouts of Storm Drain Inlets

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Most cities are drained by an elaborate network of storm drains that carry urban runoff from streets to receiving waters. Depending upon the design of the system, the storm drain system has some capacity to capture and temporarily store sediments and debris. Storage components include drop inlets, sump pits or catch basins.

While the storage capacity of each component of the system is small relative to the volume of storm water that passes through them, drop inlets can temporarily trap some coarse sediments during smaller storms. For example, Pitt (1985) in a study in Bellevue, Washington, concluded that catch basins could trap and retain sediments up to about 60% of their total basin volume. However, large storm events often flush out the trapped sediments and convey them downstream.

Many public works departments annually remove the sediments that accumulate in storm drain inlets using vactor trucks or manual methods. The following questions were addressed by this study: (1) If urban pollutants are present within the trapped sediments, would more frequent cleaning have any value as a stormwater treatment practice? (2) If so, would cleanouts be a feasible and cost-effective strategy compared to other stormwater practices?

To answer these questions, a consortium of local agencies in Alameda County, California began an extensive study of sediments trapped in 60 storm drain inlets. The study examined both the volume and quality of trapped sediments within residential, commercial and industrial storm drain inlets that had been cleaned with either a monthly, quarterly, semi-annual, or annual frequency.

The drop inlet design employed in this semi-arid region of the country is 41 inches long, 25 inches wide, with depths ranging from 16 to 54 inches. These inlets were not designed to trap sediments. Site visits indicated that the material trapped in the inlets consisted of a diverse mix of trash, leaves, woody debris, decomposing organic matter and coarse sediments (Table 1). A grain size analysis indicated that over 80% of all sediments were sand (62 to 2,000 microns). About a third of all inlets were wet or had standing water. Oil sheens, methane, and obvious illegal discharges were rare (usually less than 5% of all inlets), except for industrial areas (15%)).

The study found that the trapped sediments in the storm drain inlets were highly enriched with trace metals and petroleum hydrocarbons (Table 2). Residential inlets had the lowest sediment metal concentrations, but also exhibited the highest concentration of petroleum hydrocarbons. Commercial sites, which included a large mall and several vehicle maintenance operations, were generally comparable to those seen at the industrial sites, with the exception of zinc, which was higher in commercial areas.

In general, the quality of the inlet sediments was in the same range as that reported for San Francisco catch basin sediments, somewhat lower than those observed in oil grit separator sediments, and slightly higher than the concentration found in street dust. The study also presented evidence that most hydrocarbons in inlet sediments could be traced to the products of combustion which contain large ring structures (soot, exhaust, etc.) rather that direct spills of petroleum products themselves which generally contain smaller ring structure.

The major objective of the study was to investigate whether an increased cleaning frequency could result in an increased removal of storm water pollutants, and if so, determine an optimal cleaning frequency that achieved maximum pollutant removal. The study found that maximum annual sediment volume could be removed by monthly cleanouts (three to five cubic feet)

Table 1: Summary of Storm Inlet Debris Characteristics (reported as percent of inlets with indicated characteristic)

Characteristic	Residential inlets (%)	Commercial inlets (%)	Industrial inlets (%)
Wet	30	26	55
Trash	60	63	52
Soils	34	48	69
Leaves & wood	63	75	67
Organic material	32	28	59
Rotten egg smell	4	1	21
Illegal discharges	2	5	1
Oil/Sheen	4	1	15

Table 2: Storm Inlet Sediment Quality (median concentrations in mg/kg)				
Land use type	Copper	Lead	Zinc	Total petroleum hydrocarbon
Residential	37.9	43.8	215	5000
Commercial	56.7	111	597.5	2050
Industrial	46.6	117	307	1950

while quarterly, semi-annual and annual cleanouts removed about the same amount of material (1.5 to 2.5 cubic feet).

For industrial inlets, monthly cleanouts removed nearly six times more sediment than annual cleanouts. A qualitative analysis of the data indicated no seasonal differences between the volume of material removed from the different storm inlets. Figure 1 shows the average mass of sediment removed per cleaning at each inlet for monthly, quarterly, semi-annual and annual cleanouts. The rising solid line indicates that the material accumulates over time. However, a substantial amount of trapped sediment flushes out prior to operation when the operation is performed only once or twice a year (Figure 1) and therefore, a much greater annual mass of sediment could be removed through monthly cleaning. The study estimated that monthly cleanouts could reduce annual copper loads to San Francisco by three to 4%, and possibly higher (11 to 12%) if the monthly cleaning captured illegal dumping and other metal hotspots.

The study concluded that the modest pollutant removal benefit of more frequent clean outs of storm inlets needs to be balanced by the significant jump in municipal costs and staffing it would create.

References

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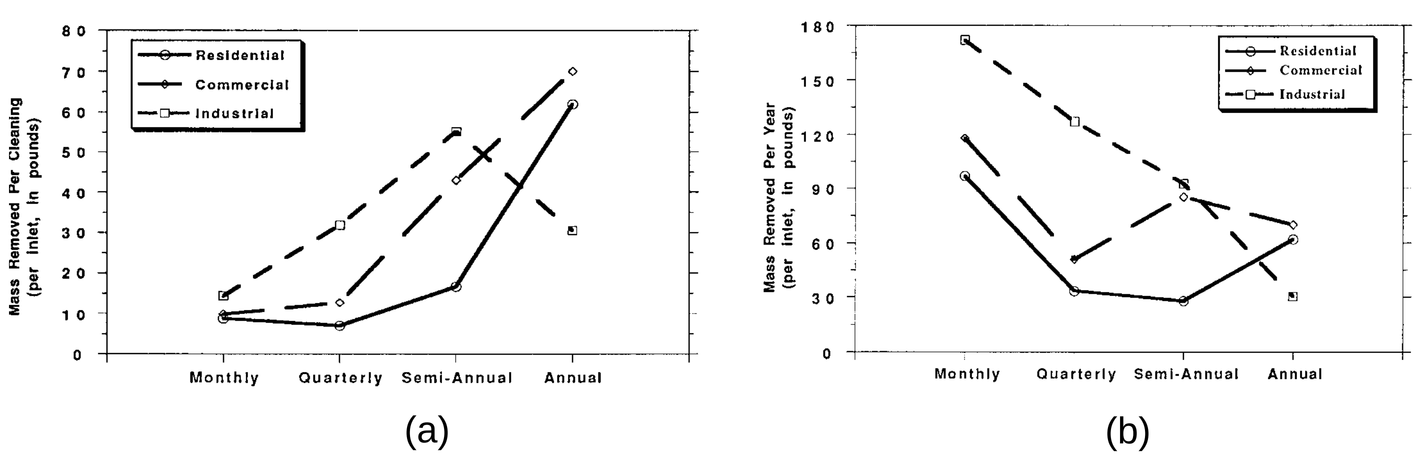

Figure 1: Mass of Sediment Removal in Storm Drain Inlets as a Function of Cleanout Frequency (a) pounds per cleanout and (b) pounds per year