### 5.5.1 Street Sweeping

***Description***

Street sweeping is the preventive practice of removing large debris and small particulate matter from street surfaces. Regular street sweeping prevents buildup of sediments in the stormwater distribution system and the contamination of receiving waters.

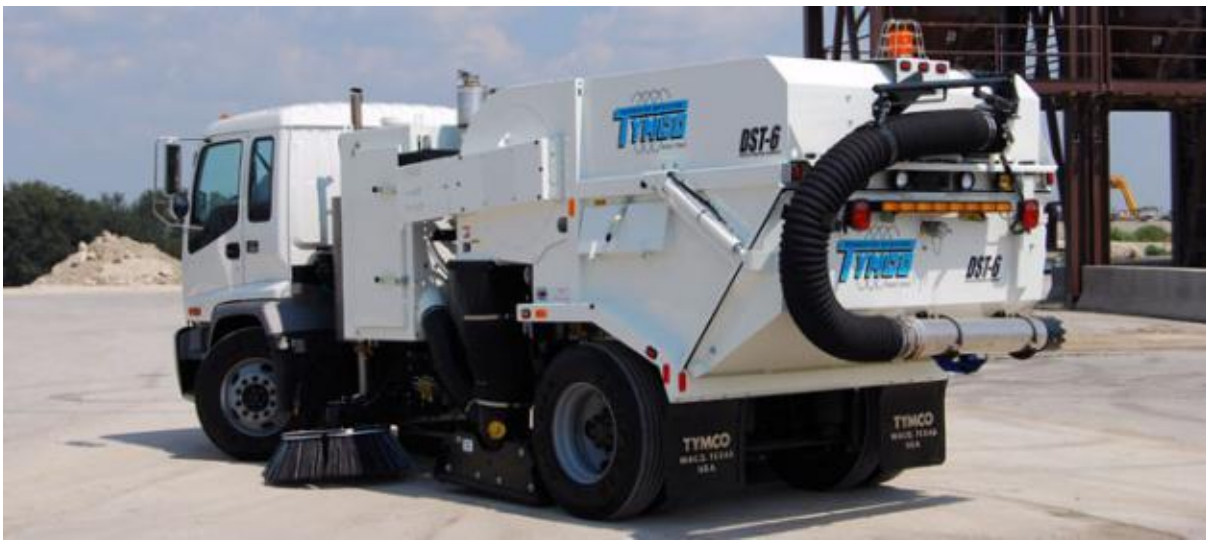


**Figure 5.5.1-1. This regenerative air street sweeping unit removes both large debris and fine particulates (http://www.tymco.com/sweepers/model-dst-6/index.htm, accessed August 2012).**

**BMP Functions Table**

| BMP | Applicability | Volume Reduction | Water Quality | Peak Rate Reduction | Recharge | Runoff Temperature Mitigation | Heat Island | Habitat Creation | Maintenance Burden* | Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Street Sweeping | U/S | L | M | L | L | L | L | L | M/H | L/M |

KEY: U = Urban; S = Suburban; R = Rural; H = High; M = Medium; L = Low

*Maintenance burden varies depending on equipment manufacturer and pollutant loading from contributing land use.

***Key Design Features***

- Street sweeping programs must be designed in accordance with specific site characteristics, including traffic volume, land use around the area to be swept, and proximity to receiving waters.
- Street sweeping frequency must be increased in areas where sediment and debris accumulation is observed.
- Street sweeping programs must include a mechanism to record the amount of waste collected in order to reevaluate program needs and adjust frequency of street sweeping operations in areas that generate larger amounts of sediment and debris.

***Variations***

There are several types of commercial street sweeping units. The three most common include vacuum sweepers, regenerative air sweepers, and mechanical sweepers.

Vacuum sweepers use rotating brooms that feed into a high-powered vacuum to remove brush, sediment, and debris from paved surfaces. Some models spray the area to be vacuumed with a small amount of water to control dust while others operate on dry surfaces and incorporate a filter system for dust control. Vacuum sweepers are the only type of sweeping unit permissible on porous pavements.

Regenerative air sweepers also use rotating brooms that feed into high-powered vacuums, but include direct application of forced air to dislodge any residual sediment particles that may not be captured with brooms alone. Regenerative sweepers provide the highest water quality benefits as they remove fine particulates. Regenerative air sweepers and any sweepers that use forced air are not permitted for use on porous pavements.

Mechanical sweepers use rotating brooms to direct debris onto a conveyor system for collection into the sweeper unit. Most mechanical sweepers include water for dust suppression. These sweepers are not efficient for removal of fine particles and are not recommended for use in areas adjacent to receiving waters.

***Applications***

- Residential
- Commercial
- Industrial/institutional
- Urban and suburban areas

*Advantages*

- Improves water quality of stormwater runoff from impervious surfaces.
- Implemented correctly, street sweeping may be an effective pretreatment practice for highways, parking lots, and other large paved areas.

*Disadvantages*

- Street sweeping programs must be tailored to the needs of the City and consider the surrounding land uses and their potential for pollutant contribution.
- Requires flexibility in scheduling to avoid street sweeping during inclement weather and high traffic periods.

*Applicable Protocols and Specifications*

Street sweeping must be performed in accordance with the equipment manufacturer's instructions. Programs for street sweeping must be designed to consider the frequency of sweeping operations necessary to remove accumulated sediment at an effective rate.

*Design Considerations*

Street sweeping programs can vary in terms of water quality improvement depending on the frequency of street sweeping operation, the frequency of rainfall events in the area to be swept, and the pollutant contributions from upgradient land uses.

## 1. Frequency of Street Sweeping

The frequency of street sweeping is dependent on the traffic volume of the roadway or parking area to be swept and the anticipated pollutant load from the volume of traffic; higher traffic volume areas generate higher pollutant loadings. Pollutant reduction efficiency also depends on the frequency of rainfall events. A study performed in Portland, Oregon, found very high pollutant load reductions with minimum weekly street sweeping operations in an area with relatively frequent rainfall events. This study found that regenerative air street sweepers collected 30 percent to 70 percent of particles less than 63 microns in size and 94 percent to 96 percent of particles of greater size (Sutherland and Jelen 1997).

**Table 5.5.1-1. Pollutant Contributions from Residential Source Areas, Bellevue, WA**

| Sweeping Operation | Frequency of Sweeping | | | |
|---|---|---|---|---|
| | Monthly | Twice Monthly | Sweeping Weekly | Twice Weekly |
| Schwarze EV | 51 | 63 | 79 | 87 |
| Elgin Regenerative | 43 | 53 | 65 | 71 |
| Tandem (M+V) | 33 | 41 | 49 | 53 |
| Mobil Mechanical | 17 | 23 | 29 | 33 |
| NURP Era | 0 | 0 | 0 | 0 |

**Source: Pitt 1985 (adapted from: *http://www.pacificwr.com/Publications/Newsletter_Vol4_No4.pdf,* accessed August 2012).**

### 2. Upgradient Pollutant Contributions

Street sweeping efficiency must also take into consideration the pollutant contributions from upgradient surfaces that wash onto pavements scheduled for sweeping operations. This is less a concern for largely urban areas with a high percentage of imperviousness. And, if pollutants are only carried to paved areas during storm events, street sweeping will be significantly less effective. It is important to know the drainage area and the potential for pollutants to be carried to street sweeping areas in order to develop an appropriately frequent street sweeping program.

**Table 5.5.1-2. Pollutant Contributions from Residential Source Areas, Bellevue, WA**

| | Percent Outfall Contributions from Source Areas | | | | | |
|---|---|---|---|---|---|---|
| Source Area | Total Solids | COD | Phosphate | TKN | Pb | Zn |
| Streets | 9% | 45% | 32% | 31% | 60% | 44% |
| Driveways and parking lots | 6 | 27 | 21 | 20 | 37 | 28 |
| Rooftops | <1 | 3 | 5 | 10 | <1 | 24 |
| Front yards | 44 | 13 | 22 | 19 | <1 | 2 |
| Back yards | 39 | 12 | 20 | 20 | <1 | 2 |
| Vacant lots and parks | 2 | <1 | <1 | <1 | <1 | <1 |

**Source: Pitt 1985 (adapted from: *http://rpitt.eng.ua.edu/Publications/StormwaterTreatability/Street%20Cleaning%20Pitt%20et%20al%20SLC%202004.pdf*, accessed August 2012).**

### 3. Type of Street Sweeping Unit

As discussed in the variations section, there are three general types of street sweeping units available. The sediment particle removal efficiencies vary by type of street sweeper used and the size of the particles collected on the pavement surface.

**Table 5.5.1-3. Model-Based Removal Efficiencies for a Range of Particle Size Classes and Technology**

| Particle Size | NURP-Era Mechanical | Newer Mechanical | Regenerative Air | Vacuum |
|---|---|---|---|---|
| µm | % removal | | | |
| <63 | 44 | 100 | 32 | 70 |
| 63 > 125 | 52 | 100 | 71 | 77 |
| 125 >250 | 47 | 92 | 94 | 84 |
| 250 > 600 | 50 | 57 | 100 | 88 |
| 600 >1000 | 55 | 48 | 100 | 90 |
| 1000 > 2000 | 60 | 59 | 100 | 91 |
| >2000 µm | 51 | 76 | 82 | 82 |

**Source: Sutherland and Jelen 1997 (adapted from Center for Watershed Protection, Technical Memorandum 1, October 2006).**

## 4. Water Quality/Total Suspended Solids

Street sweeping programs may be included as part of a larger stormwater management system to ensure that 80 percent TSS removal is achieved. Any areas subject to street sweeping may also be managed for water quality with additional BMPs such as grass filter strips or grass swales.

In general, the greater the traffic volume on a paved surface (roadway or parking lot), the greater the pollutant loads. The greater the pollutant loads, the greater the potential effectiveness of street sweeping.

***Operations and Maintenance***

Street sweeping operations must be carefully planned and monitored to achieve the desired performance. Observations of accumulated sediment and/or debris will require increased sweeping frequency. Street sweeping programs must include a mechanism to record the amount of waste collected in order to reevaluate program needs and adjust frequency of street sweeping operations in areas that generate larger amounts of sediment and debris than anticipated in previous program design.

Equipment operation must be performed in accordance with manufacturer instructions. Maintenance of equipment must be performed in accordance with manufacturer specifications.

***References***

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