Enhanced Street Sweeping Guidelines: How to Develop a Maximum Value Sweeping Program

Note: This document is available online at this location.

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Why Enhanced Street Sweeping: An Introduction

The graphic to the right came from this referenced study that ran from 2007 to 2019 and involved 14 MS4 locations. Keep in mind that the removal data, though outstanding, was not segregated as to whether it came from mechanical broom sweepers or from regenerative air sweepers.

A 2024 controlled test for the City of LA showed a regenerative air sweeper was more than twice as efficient at pollutant removal than a mechanical broom sweeper. That underscores the importance of specifying that air sweepers be used wherever/ whenever possible for best pollution removal.

This overview information illustrates why air sweeper sweeping may now be seen as by far the most cost-effective remedy for pavement-based pollutant removal.

Street Sweeping Far More Effective — and Cost-Effective — Than All Other BMPs for Stormwater Runoff Pollutant Removal

$Cost/Pound: TN, TP, PM for Separation or Recovery

All $Costs/Pound Updated to Reflect 2020 CPI

TN = Total Nitrogen • TP = Total Phosphorus • PM = Particulate Matter

Separation or Recovery Method	Cost ($/lb) (excluding SW landfill costs) TN	TP	PM
BMP Treatment Train[a]	$1,068	$37,243	$29.70
FL Database for BMPs[b]	$2,171	$11,995	$46.84
Screened Hydrodynamic Separator[c] (Range of costs shown in parentheses.)	$4,261 ($1,462 - 16,976)	$10,521 ($3,621 - $41,903)	$ 4.60 ($1 - $15)
Baffled Hydrodynamic Separator[c] (Range of costs shown in parentheses.)	$3,450 ($1,462 - $16,976)	$ 8,511 ($3,621 - $41,904)	$ 3.43 (1 - 15)
Catch Basin Cleaning[d] (2nd lowest)	$1,016	$1,656	$0.70
Street Cleaning (*lowest cost*)	$189	$294	$0.11

Vehicle Removal of Paramount Importance

Mandatory removal of parked vehicles during sweeping is essential

- **Mandatory vehicle removal during sweeping can increase PM pickup by 30-60% compared to sweeping around cars.** One parked vehicle will block three car lengths of curb; two spaced vehicles can block six lengths. Implementing a vehicle removal program can be cost-effective, as parking fines can offset program costs, while also significantly improving PM pickup.
- **Testing can show value of vehicle removal:**
  - Have sweeper operator use a counter to show how many car lengths are now being missed when vehicle removal is voluntary or not utilized.
  - By testing street dirt in current location/watershed the amount of pollutants now being left by not removing vehicles may be calculated.

The only way to maximize removal of pavement-based pollutants, along with other street debris, is to move vehicles out of the way of sweepers.

Developing a Citizen-Friendly Car Removal Program

Technological advances now can be utilized for better citizen acceptance and outcomes

- **Internet apps are 'game changers' for street sweeping programs:**
  - Phone/computer apps can now provide alerts to vehicle owners.
  - GPS-to-GIS apps can show where sweepers are in real time.
  - Citizens can get notice sweeper is coming and then that it has has passed by their location: Lets citizens move cars back immediately after sweeper passes.
  - Residents can also be notified if sweeper will not be coming for some reason
  - Makes environmental value of street sweeping an easier 'sell.'

- **Streamlined (less expensive) sweeping program ticketing:**
  - Ticket via cameras on sweepers; ticketing info can be transmitted directly to ticketing agency
  - This eliminates parking enforcement involvement and expense for ticketing.
  - Tickets will still pay for a significant portion of sweeping program costs.
  - That residents can re-park right after sweeper will be seen as a huge community benefit.

By using technology in your sweeping program the cost is reduced and the value increased for both your program and for your citizens

Sweeper Type Used is Extremely Important

Regenerative air sweepers have been documented as picking up as much as 90-95% of material on pavement, including the more polluted small-micron

- **Mechanical Broom Sweepers** have no vacuum-type component: accumulated debris is tossed by main broom onto a conveyer belt. Mechanical broom sweepers should NOT be used under normal operating conditions by those wanting to enhance their street sweeping program. Mechanical broom usage should be limited to freeway/highway sweeping where there are no curbs, as well as conditions with much heavier than normal accumulation, like following large storms and during spring clean-ups in cold climates.

- **Vacuum Sweepers**, one type of air machine, should be used primarily to clean porous pavements. Since vacuum sweepers continually exhaust used air, they can have negative impacts on air quality.
- **Regenerative Air Sweepers** are STRONGLY RECOMMENDED for enhanced street sweeping programs. Unlike vacuum sweepers, a regenerative air sweeper constantly re-circulates (regenerates) its air supply internally.
- **Click here** to see comparison between broom and air.

How Regenerative Air Works

Street Pavement Conditions and Barriers

Do not regularly sweep uncurbed streets; instead, occasionally sweep them.

- **Street sweepers have difficulty picking up street dirt on pavements classified as "poor or fair" due to cracks and deep depressions where dirt can accumulate.** Uneven surfaces make it difficult for sweepers to operate effectively, especially the newer air machines classified as regenerative or vacuum.
- **Support repaving projects since they improve stormwater quality.** Until poor and fair pavements are replaced, ensure that all street cracks are sealed with tar. The goal is to achieve "good" pavement conditions throughout a community.
- **Street dirt accumulates within a few feet of barriers like curbs and New Jersey median barriers.** As a result, performing sweeping operations primarily on curbed streets is the best use of available resources.

Sweeper Upkeep and Usage

How sweepers are maintained, sweeping frequency and forward speed all important

- **Maintenance of Equipment:** Well-maintained air machines outperform mechanical ones in picking up contaminated PM. Maintenance includes regular replacement of worn gutter booms, changing engine oil, and ensuring moving parts are functional.
- **Forward Speed of the Sweeper:** A speed of 3-6 mph is typically recommended for heavy accumulations. However, speeds of 8-10 mph only reduce particulate pickup by 10-15%, allowing for more street miles to be swept and more pollutants removed in a single day.
- **Sweeping Frequency:** Frequency depends on land use and street type, with common schedules being weekly, bimonthly, or monthly. More frequent sweeping should occur on streets with higher dirt accumulation, especially in high-traffic areas. Daily or bi-weekly sweeping in downtown areas is often wasteful if the goal is to maximize contaminated particulate collection.
- **Tandem Sweeping:** In very heavy debris conditions mechanical broom sweeper may be required. However, tandem sweeping — where a regenerative air sweeper follows a mechanical one — can effectively recover toxic pollutants that in large part are attached to fine particulates.

Optimize Sweeping Frequency

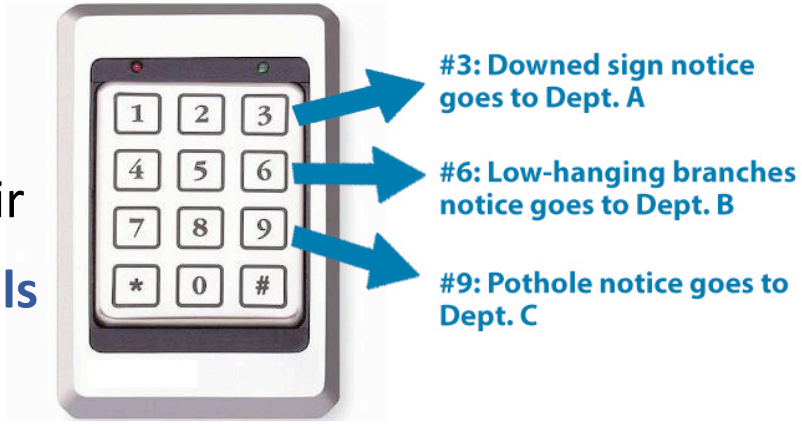
Ideally, frequency should be based upon watershed information data

- **Adjust frequency as a BMP:** Consider land use and street type. Implement more frequent sweeping in:
  - High-accumulation areas: Implement street dirt accumulation monitoring
  - Where testing shows higher pollutant loads
- **Program optimization may include:**
  - Software like SIMPTM that can be used to model pollutant removal
  - Sweeper pickup performance monitoring
  - May conduct controlled street sweeper pickup performance testing
- **Ideally integrate with stormwater management department:**
  - Integration with the stormwater management program helps allocate funding to meet shared goals of pollutant removal.
  - Best to allocate resources based upon data-driven insights

Other Technology Can Increase Value of Sweeping

Sweeping program may be offset by using value-enhancing systems offered by new tech.

- **AI- and camera-based collection/notification systems:**
  - Downed signs, failing pavement, low-hanging branches, etc.
  - Send direct notifications to departments responsible for repair
- **Sweeper hopper graphics can showcase civic/environmental goals**
- **'Advertise' health and safety benefits of street sweeping:**
  - Put information prominently on website
  - Create elementary school education modules
  - Have sweeper naming and sweeper graphic design contests with kids
- **Include sweepers in 'Touch-a-Truck' events:**
  - Offers information and helps to educate adults and kids about value of sweeping
- **Keep up-to-date:**
  - Stay informed about new technologies and best practices
  - Participate in or follow results of ongoing research and testing



Extra Credit Possibilities…

Working to create TMDL removal credits is working in other states due to current data

- **Pollution removal credits are gaining ground**
  - Florida now offers pollutant removal credits aligned with both MS4 and TMDL compliance.
    - Minnesota is reportedly moving in that direction, as well as some NE states.
  - Compiling and distributing efficiency data in your sweeping program can be used to try to gain high-level pollutant removal credits for your stormwater permit program.
  - Recent data on street sweepers — that they are up to 700% more effective at removing phosphorus and nitrogen from the runoff stream — and that you have an enhanced sweeping program, can be used to help enact pollution removal regulations in your state that provide permit credits due to your street sweeping program being designed for pollutant removal.

Be guided by the knowledge that studies show street sweeping is the first line of defense for pavement-based pollutant removal.

For More Information...

As of 2025, the two people providing this information have nearly 100 years of experience with street sweeping, including testing. For assistance with questions you may have about any aspect of your sweeping program, contact:

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