Maryland Department of the Environment

MDE response to Street Sweeping Expert Panel Report

January 19, 2016
CBP Urban Stormwater Workgroup

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MDE TMDL Program

Outline

Item 1: Because street sweeping primarily addresses sand, the impacts might be largely attenuated before reaching the modeled river reaches

- **Item 1a:** This could also be a factor for EOS loads to the Bay

Item 2: Regenerative air sweepers might not have a significant impact on tidal water quality due to the size distribution of particles that are addressed

Item for WTWG: Given that most urban sediment comes from channel erosion, the TSS reductions associated with this practice should not exceed the contributions upland erosion

Item 1: Stream to River Delivery

Item 1: Because street sweeping primarily addresses sand, the impacts might be largely attenuated before reaching the modeled river reaches

- Street dirt is mostly sand
- Street sweepers preferentially pick up sand over fines
- 96% of sand eroded from the edge-of-field does not reach the edge-of-stream (100 cfs river reach) [1]
- There should be a factor to account for the loss of sand between the end-of-pipe and the modeled river reaches (or tidal waters)

[1] USEPA (U.S. Environmental Protection Agency). 2010. Chesapeake Bay Phase 5.3 Community Watershed Model. EPA 903S10002 - CBP/TRS-303-10. U.S. Environmental Protection Agency, Chesapeake Bay Program Office, Annapolis MD. December 2010.

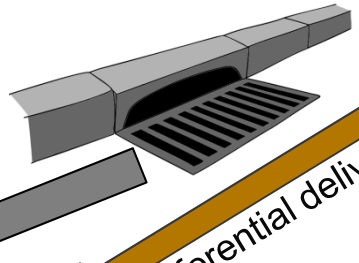
Item 1: Stream to River Delivery

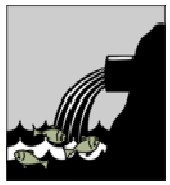
Approximate particle grain definitions used in this slide:
- coarse: > 2,000 microns
- medium: 63 – 2,000 microns
- fine: < 63 microns

Street Dirt *
- 90% coarse- & medium-grained
- 10% fine (silt and clay)

Pick Up Efficiency *
- coarse grains: 35 – 50%
- medium grains: -5 – 40%
- fine grains: -50 – 10%

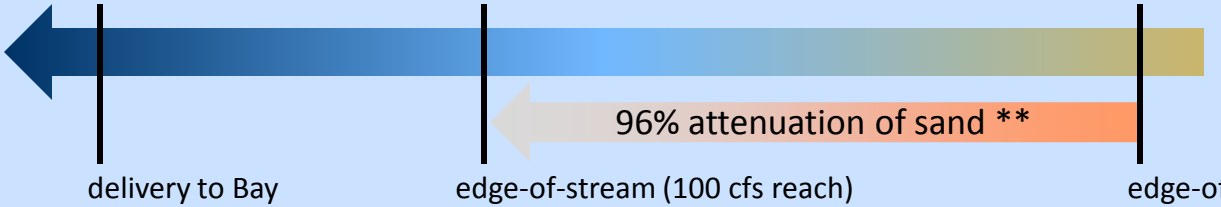
WinSLAMM Model





end-of-pipe

Preferential delivery of fines



Phase 5.3.2 Watershed Model

* Street and Storm Drain Cleaning Expert Panel Report (2015)
** Phase 5.3 Community Model Documentation, Section 9, "Sediment Simulation", 2010

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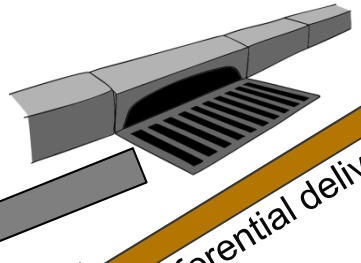
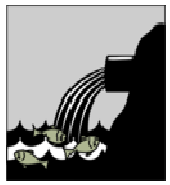
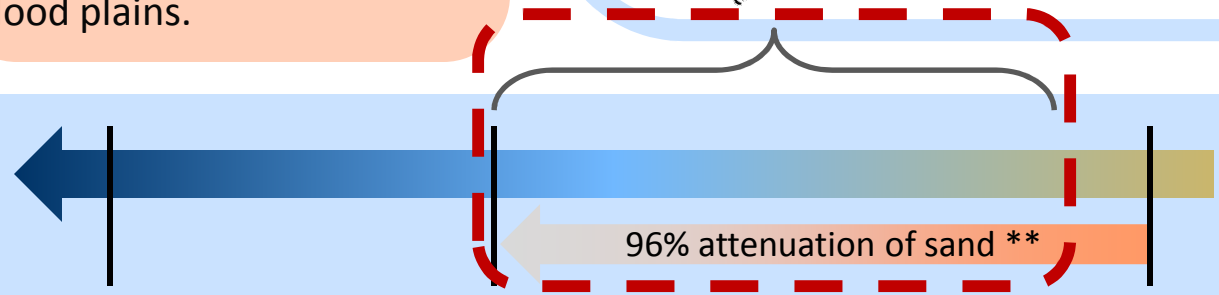




end-of-pipe

Preferential delivery of fines

Need an additional factor to account for small stream losses of sand. According to Section 9.7 of the P5.3 model documentation, this sediment can be stored in lower-order streams, river valleys and flood plains.



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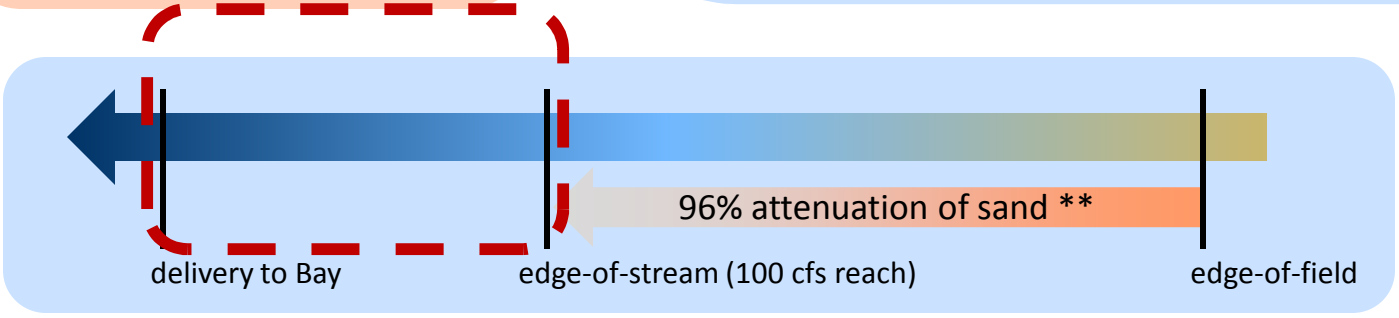
Item 1a: River to Bay Delivery

Table 9-17. Percent fines (silt and clay) in Chesapeake rivers

Basin	% fines Median	% fines Mean	% fines Max	% fines Min
Susquehanna	97%	95.3%	100%	71%
Potomac	91%	87.6%	100%	47%
Patuxent	92%	89.9%	100%	49%
Rappahannock	85%	80.6%	100%	6%
Mattaponi	81%	76.9%	100%	5%
Pamunkey	87%	84.5%	100%	9%
James	85%	81.1%	100%	19%
Appomattox	90%	85.1%	100%	47%
Choptank	90%	86.3%	100%	50%

The model documentation indicates that at the RIM stations, that 76.9% to 95.3% of TSS loads are composed of fine sediments

Additional attenuation would be expected to occur in larger rivers, however, because most of the urban area in the state is close to tidal waters, this would be very difficult to estimate without additional modeling



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Item 2: Regenerative Air Sweepers & Fine Sediment

Item 2: Regenerative air sweepers might not have a significant impact on tidal water quality due to the size particles that are addressed

- Regenerative air does not appear to be effective at picking up fines, and according to Selbig and Bannerman's 2007 study, might increase fines in that are available for export
- A brief survey of trade publications indicates that this may be due to the closed loop system propelling silt-laden air into pavement pores
- Fine sediments are associated with high delivery rates to the Bay and with water clarity problems since they have a lower settling velocity than sand
- Vacuum assist sweepers, on the other hand, appear to pick up sediment across the range of grain sizes
- Assigning a lower efficiency to regenerative air sweepers might be reasonable.

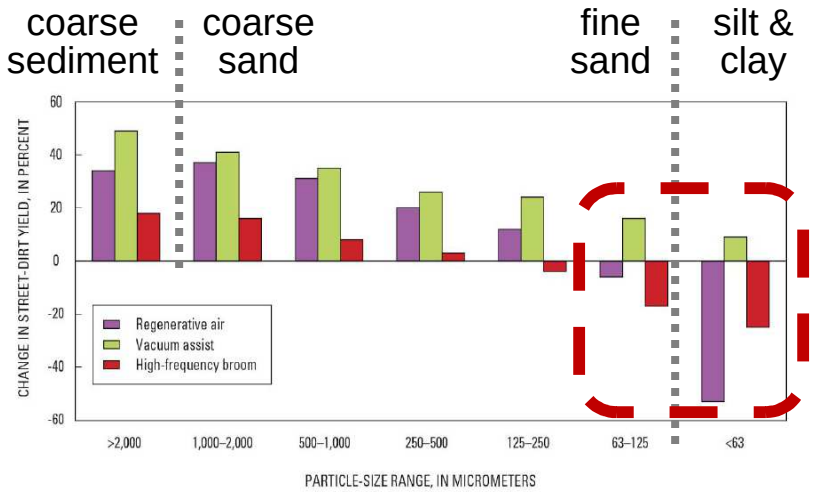

Figure 6 Comparative pick up efficiency of three types of sweepers (Selbig and Bannerman, 2007).

Observed increases in silt & clay yield from roads cleaned with regenerative air sweepers

Item for WTWG: Street Sweeping and Channel Erosion

Item for WTWG:

- "Langland and Cronin (2003) point out that 'for the watershed as a whole, approximately two-thirds of the sediment load was the result of channel erosion' because of the concentrated flow from impervious areas. Street sweepers preferentially pick up sand over fines"[1]
- Given that:
  - TSS removal for 100 passes per year can reach 21%
  - channel erosion contributions are estimated be greatest in highly impervious areas
  - there appears to be a potential for exceeding the sediment load within a watershed
- The Watershed Technical Workgroup may be able to answer this question.

[1] USEPA (U.S. Environmental Protection Agency). 2010. Chesapeake Bay Phase 5.3 Community Watershed Model. EPA 903S10002 - CBP/TRS-303-10. U.S. Environmental Protection Agency, Chesapeake Bay Program Office, Annapolis MD. December 2010.

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