Memo

To: Urban Stormwater Workgroup

From: Normand Goulet

Date: 3/1/2011

Re: Street sweeping/BMP Era Recommendations

Message

As you may remember, the Urban Stormwater Workgroup recommended that the Bay Program develop BMP removal efficiencies for Street Sweeping and the Maryland BMP by Era Approach. As such a Expert Panel was assembled to review the proposals and provided the following recommendations.

Use of the MD BMP Design Era Proposal

The Panel considered the proposal by MDE to use a composite BMP to define nutrient reductions in the various stormwater design eras in the state from pre-1985 to post 2010 (MDE, 2010).

In general, the Panel felt that overall technical approach in defining the four design eras was technically sound, Each design era can be defined based on unique BMP sizing, performance and design standards, and each era also includes a unique combination of BMPs. The panel concluded that such an approach would yield more accurate sediment and nutrient reduction data, while minimizing the BMP reporting burden on localities and state agencies.

The Panel concluded that the composite BMP removal rates were technically sound for three of the four design eras, and make sense to incorporate into the model input deck.

The Panel disagreed with the composite removal rates presented for the design era from 1985 to 2001, which were developed, at least in part, by the analysis of Baish and Caliria (2009). The consensus was that the removal rates for this design era were too generous, and did not adequately discount the effect of improper design and installation, the effect of BMP age (BMPs from this era are now 10 to 25 years in age) and loss of performance due to lack of non-routine maintenance to maintain hydrologic performance and remove and dispose of trapped pollutants.

There were also two technical concerns about the Baish and Caliri (2009) analysis. The first were that the specific removal rates assigned for these older BMPs were identical to and, in a few cases, more generous than those developed by the Bay Programs Urban Stormwater Work Group for current BMPs. The most notable example were for infiltration, extended detention and wet ponds, which tended to be the most common practices employed during this design era. The Panel concluded that the pollutant removal discounts for this design era were too modest,

The Panel spent considerable time discussing the scientific and engineering basis for a proper discount for stormwater practices in this era. Although several studies of BMP longevity and performance have been under taken in the Bay watershed (for example, Galli in Prince George's County and Hirschman in the James River Watershed), they could not provide an adequate numeric discount.

The panel finally settled on an engineering basis for making the discount, which reflected the difference in water quality sizing between design era 2 and 3. Although there were some local variability, most BMPs in Maryland were sized based on the runoff from a half- inch of rainfall, and to less stringent design standards.

With the advent of MDE's 2000 manual, BMP sizing greatly increased, with BMPs designed to treat runoff from the 1 inch storm as well as provide channel protection for the one year storm. The landmark 2000 manual also contained more stringent design requirements for BMP geometry, maintenance and pre-treatment. The volume of runoff treated more than doubled between the two design eras. Therefore, there is an engineering basis to suggest, regardless of practice type, that removal rates for design era 2 would be around half that of design era 3. This would shift TSS/TP/TN removal rates to 40, 30 and 17% for design era 2.

The Panel concluded that the MD design era proposal would be acceptable if this modification were made to the composite BMP rates for design era 2.

The Panel noted that the one potential future improvement would be more accurate reporting of historical and local BMP implementation data, since the design era is very sensitive to the treated drainage area numbers that Phase 1 MS4 communities report to the state. The potential for double counting is fairly high, based on recent experience in analyzing the BMP inventory and drainage area data in Montgomery County, MD.

The Panel noted that the basic concept of the design era would be useful in other Bay states, but that the time lines for design eras would need to be customized to reflect the different evolution of their local and state stormwater regulations and standards over time.

Finally, the Panel noted that the issue urban BMP performance over time was a critical research priority, and that the systematic study of a large population of older urban

BMPs would provide extremely useful management information for local and state stormwater agencies as they begin to undertake more detailed nutrient tracking to meet the Bay TMDL and local MS4 permit requirements. Removals and performance for **all** eras may need adjustment, up or down, in future scenarios as impacts of aging, maturation, and maintenance (or lack thereof) on all BMPs are quantified.

Summary Table

Era	Total Nitrogen	Total Phosphorus	Total Suspended Solids
BMP 1: Retrofits	25%	35%	65%
BMP 2: 1985-2001	17%	30%	40%
BMP 3:2002 -2010	30%	40%	80%
BMP 4: Post 2010	50%	60%	90%

Street Sweeping

Localities can use one of two methods to compute the projected nutrient reduction associated with street sweeping.

The first, and most preferred method, is the **mass loading approach**, whereby the mass of street dirt collected during street sweeping operations is measured (in tons) at the landfill or ultimate point of disposal.

Convert tons into pounds of street solids (multiply by 2000)

The mass of solids is then converted to dry weight using a factor of X

TSS load reduction is estimated by reducing the total particulate mass by the fraction of the swept material less than 250 microns (or a comparable threshold) reflecting the particle sizes that dominate TSS. In its 2009 street sweeping pilot study[i], Seattle Public Utilities estimated TSS removal from street sweeping that was typically 10-20% of the total dry sediment load recovered – considering the particle fraction smaller than 250 μm contributing to TSS. The particle size distribution for recovered street sweeping solids by Law et al. (2008) showed approximately 30% of the recovered solids in this TSS size range (i.e. ≤ 250 μm) by mass.

The nutrient content of the solids is based on sediment enrichment data reported by Law et al (2008), adjusted from original mg/kg values of 1200 (TP) and 2500 (TN)

- Lbs of TN = 0.0025 pounds of dry weight sweeping solids
- Lbs of TP = 0.001 pounds of dry weight sweeping solids

The second method is **the qualifying street lanes approach**. The locality reports the number of qualifying lane miles they have swept during the course of the year.

This is then converted into total acres swept by multiplying the miles (5280 feet) by the lane width (10 feet) and dividing by 43,560. If both sides of the street are swept, than the impervious acreage can be doubled.

The pre-sweeping annual nutrient load for the swept acres is defined using the Simple Method (Schueler, 1987).

TP = 2.0 lbs/impervious acre/year
TN = 15.4 lbs/impervious acre/year

The locality would multiply the total acres swept by the annual nutrient load to arrive at a baseline load.

The baseline load would be adjusted by the factors in Table 1 below to determine the load reduction associated with street sweeping.

Table 1. Multipliers (reduction fractions) to Reflect Effect of Street Sweeping on the Baseline Load [1]

Technology	TSS	TP	TN
Mechanical	.10	.04	.04
Regenerative/Vacuum	.25	.06	.05

[1] interpolated values from weekly and monthly street sweeping efficiencies as reported by Law et al (2008)

The panel felt that the conceptual model developed by Law et al (2008) was logical and reflected the monitoring data collected in the Baltimore field study, and the wider scientific findings in the literature survey. The panel chose to assign a single removal rate for street sweeping based on a bi-weekly frequency for qualifying street conditions as outlined below.

Nonetheless, the data for the **qualifying street lanes approach** are highly variable, the database is small, and some performance inconsistencies were noted. The performance multipliers may require adjustment as more information becomes available.

<u>Qualifying Conditions for Street Sweeping Nutrient Reductions</u>

The sediment and nutrient reductions only apply to an enhanced street sweeping program conducted by a municipality that has the following characteristics

- An urban street with an average daily traffic volume of more than ADT located in commercial, industrial, central business district, or high intensity residential setting

- Streets are swept at a minimum frequency of 26 times per year (bi-weekly), although a municipality may want to bunch sweepings in the spring and fall to increase water quality impact.

- The reduction is based on the sweeping technology in use, with lower reductions for mechanical sweeping and higher reductions for vacuum assisted or regenerative air sweeping technologies.

- Localities need to document the length of lane miles swept using their traditional routes

Note on Catch Basin Cleaning.

Prior municipal surveys indicate that no Bay municipality cleans out its network of storm drain inlets or catch basins frequently enough to produce water quality improvements (Law et al 2008). However, it is clearly possible to implement a systematic, water quality- based storm drain cleanout program where quarterly cleanouts would be performed at targeted inlets with the highest accumulation rates. Some system municipal inspections would be needed to identify the priority inlets. The projected nutrient reduction associated with an enhanced storm drain cleanout program would be computed using the **mass loading approach** described in Part A of this memo. Material classified as "trash" should not be included in the sediment and nutrient load reductions.

As data become available, comparisons between **the mass loading approach** and the **qualifying street lanes approach** should be compared to ensure that the reduction credits being received are in relative agreement.

References.

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Law, N., K. Diblasi and U. Ghosh. 2008. Deriving reliable pollutant removal rates for municipal street sweeping and storm drain cleanout programs in the Chesapeake Bay Basin. Center for Watershed Protection. Ellicott City, MD.

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Schueler, T. 1987. Controlling urban runoff: a practical manual for planning and designing urban BMPs. Metropolitan Washington Council of Governments

[i] Seattle Public Utilities (2009) Seattle Street Sweeping Pilot Study. Prepared by SPU and Herrera Environmental Consultants. April 22, 2009. Accessed online 30July 2010 http://www.seattle.gov/util/stellent/groups/public/@spu/@ssw/documents/webcontent/spu01_005046.pdf