Technical Documentation for Phosphorus Loads from the Urban Sector

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Over the last several years, the Chesapeake Bay Program's Urban Stormwater Work Group developed a technically credible approach on how phosphorus loads are simulated in the Phase 6 Chesapeake Bay watershed model. While this approach differs from the one taken by the agricultural sector, it reflects the unique phosphorus sources, inputs and dynamics of the urban sector, and is based on three recent scientific and technical reports that have been approved by the partnership (UNM EP, 2013, Sample et al, 2015 and Tetra Tech, 2015). Some of the key findings from the urban sector P review are provided below:

Urban pervious lands have much different P inputs than crop land. For example, only half of urban turf in the Bay watershed is fertilized, and no urban lands receive any manure applications (like their agricultural counterparts). Indeed, while some lawns are fertilized, the P inputs are now historically very low. P fertilizer inputs have dropped sharply in recent years in response to state laws that have limited P content in urban lawn fertilizer in MD, VA, DC and NY. One consequence of these laws, is that it prompted an industry phase out of P in lawn fertilizer, which resulted in an 85% decline in non-farm fertilizer sales in the state of DE (Table 7, p. 17, UNM EP, 2013).

The urban sector has many other sources of P inputs than fertilizer and manure. These include atmospheric deposition, leaf drop from tree canopy, lawn biomass, soil erosion, urban stream bank erosion and discharges from grey infrastructure. For a comprehensive review of these sources, please see Sample et al (2015).

Phosphorus concentrations in urban runoff are well understood and very consistent across the Bay watershed and the nation. The National Stormwater Quality Database provides an empirical basis to examine urban phosphorus dynamics and contains a statistical analysis of more than 7,000 individual monitored storm events (Pitt, 2014). Two recent research summaries found that event mean concentrations (EMCs) of phosphorus are very consistent along the range of urban land uses in the watershed (Tetra Tech, 2014 and Figure 4 of Sample et al, 2015). Consequently, the urban sector has high confidence that the estimates of phosphorus loads from both impervious and pervious lands in the Phase 6 watershed model are consistent with observed runoff monitoring data. More documentation on the methods for simulating P loading rates in developed lands in the Phase 6 model can be found in Chapter 2.2.4.1.1 on page 2-13.

Soil P levels do not appear to be a major factor influencing the variability in P loss from urban land. The Urban Nutrient Management Expert Panel (UNM EP) (2013) looked into how P loss was simulated from urban pervious land (see Figure 3 in the Panel report) and found that high soil P was only one of 11 risk factors influencing P loss from pervious land. They recommended that a high risk/low risk be assigned to

pervious lands to determine nutrient reduction credit for written urban nutrient management plans.

The APEL model was developed exclusively for crop and pasture land, and has no applicability to the urban sector. Soil P testing is not commonly undertaken in urban areas (usually only when UNM plans are written) and there is no comprehensive geographic database of urban soil P values in the watershed that could be used for any other Soil P model.

The urban sector is somewhat surprised that this sector equity issue has come up at such a late hour, since neither the CBP agricultural or modeling workgroup has brought it to our attention. It is our understanding that the APEL model does not change the total load within a sector but only changes its geographic distribution. Consequently, we contend that the lack of an explicit soil P model in the urban sector does not creates any sector inequity and does not rise to the standard of a fatal flaw in the Phase 6 watershed model review.

The Urban Stormwater Work Group has indicated its willingness to participate in future STAC workshop on this topic should it be organized.

References:

Pitt, B. 2014. Current edition of the national stormwater quality database. University of Alabama.

Sample, D. et al. 2015. The Peculiarities of Pervious Cover: A research synthesis on allocating pollutant loads to urban land uses in the Chesapeake Bay. A STAC Workshop report. STAC Publication 15-001

Tetra Tech, Inc. 2015. Urban Land Use Loading Literature Review: Task Summary and Results. Technical Memo Prepared for Urban Stormwater Work Group of the Chesapeake Bay Program Partnership. Annapolis, MD.

Urban Nutrient Management Expert Panel (UNM EP). 2013. Recommendations of the expert panel to define removal rates for urban nutrient management. Final panel report. Approved by Water Quality Goal Implementation Team. March, 2013.