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General Information Needs for Adding Proprietary Stormwater Treatment Devices in WinSLAMM

WinSLAMM uses traditional unit processes to describe the performance of proprietary stormwater controls, supplemented with and verified by actual performance test data. For example, the performance of hydrodynamic devices can usually be successfully described using traditional flow routing and particle settling calculations. Special features to minimize scour and/or to trap floatables can enhance their performance and can be incorporated in the model. Sieving or membrane filters usually requires additional information pertaining to the effects of the captured material on the surface on the removal of the particles with use. Media filters require the most information due to the additional bio-chemical removal mechanisms involved. A combination of controlled laboratory and actual field monitoring performance data is usually needed to obtain the information needed to develop the algorithms used in WinSLAMM.

When the information is submitted, we carefully review and analyze the data to develop performance functions and algorithms according to significant design and operational factors. A white paper is then prepared and reviewed by the vendor and appropriate changes made. The model input screen(s) are then designed in conjunction with the vendor to minimize data entries needed by the model user and to cover the range of device model options. The performance algorithms are then coded and the model performance is carefully reviewed and verified with actual performance data supplied by the vendor.

The most successful implementations are based on a substantial set of performance information. Specifically, the following data are usually needed:

1) **Influent and effluent concentrations, by particle size range, for particulate solids.** It is common to use Sil-Co-Sil particles with known particle sizes during controlled laboratory performance tests. However, both influent and effluent concentrations by particle size are needed. This information is used to develop influent vs. effluent performance curves for each particle size category over a wide range of influent concentrations. These data are also needed for different treatment flow rates to indicate how the device (usually) improves in performance for lower flow rates than the maximum treatment flow rate. If some of these data are not available, it may be possible to proceed with suitable assumptions. Typical size ranges used in the model include: filtered (“dissolved”) solids (<0.45 µm), 0.45 to 3 µm, 3 to 12 µm, 12 to 30 µm, 30 to 60 µm, 60 to 120 µm, 120 to 250, µm, 250 to 1180 µm, and >1180 µm, along with total (SSC). It may be important to also distinguish floatable material and large organic debris (such as leaves and grass clippings) for use with future planned model enhancements.

2) **Filtered ("dissolved") pollutant performance information** to indicate how the device removes these constituents. These data are statistically evaluated to identify significant concentration changes based on the number of data available and the magnitude of the differences. Removal algorithms are developed for the filtered constituents having significant changes. We model particulate-bound pollutant removal based on the particle size removal information. Filtered pollutant removal may not be important for devices that do not have any active treatment media, and performance data may therefore not be available, or needed. In that case, if the device is only based on physical settling or screening, no filtered pollutant removals will be calculated. Typical filtered pollutants of most interest include filtered phosphorus, nitrates+nitrites, filtered nitrogen, ammonia, filtered metals (Cu and Zn, plus any others of local importance such as Al, Cr, Cd, Fe, Mn, and Pb). Although not actually a filtered constituent, bacteria (enterococci and *E. coli*, or fecal coliforms) also require separate performance algorithms. WinSLAMM can also calculate the influent quality and performance of other constituents, such as PAHs (subject to available calibration data), so all available performance data available should be included for evaluation for inclusion in the model.

3) **Treatment flow rates** as a function of stage and/or other hydraulic parameters, including typical bypass configurations, in-line and off-line storage, pumping rate or other appropriate flow parameters. These are the most critical data needed as the hydraulic modeling has to correctly calculate the treatment flow rates and bypasses for a variety of conditions. WinSLAMM calculates mass balances for all stormwater flows, including untreated and partially treated bypasses, infiltration, evapotranspiration, evaporation, underdrain flows, etc., as part of the removal calculations for each event. Since WinSLAMM routes all flows, particulates and pollutants through the modeled drainage system, all controls and upgradient conditions above the treatment device affect its performance.

4) **Loss of treatment flow rate capacity with time**, usually a function of clogging. This is used to modify the performance of the device with time and use, and to calculate maintenance intervals, or time to failure. Descriptions of typical maintenance operations (such as removal of trapped sediment, cleaning of filters or membranes, replacement of media, etc.) are also needed. Also, the data should account for how the flow performance is altered after maintenance, if applicable. An example would be porous pavement cleaning that does not completely restore initial treatment flow rates.

5) **Laboratory and Field Data** are both important for the analysis. Much of this information can be developed in controlled laboratory tests, but full-scale installation performance is also needed to verify these data under a range of actual conditions. The effects of actual stormwater particle specific gravities on performance, compared to the specific gravity of Sil-Co-Sil material, for example, and the effects of highly varying flow rates during actual events compared to the typically constant flow laboratory tests affect the performance of stormwater control devices and need to be incorporated in the model.

6) **Actual dimensions for the devices** for different options to minimize the amount of information that the model user needs to enter. As noted above, this information is used to develop the input screen(s) covering the selections of models and options. Extensive reviews by the vendor

representatives are needed during the development of input screens, and to review and clarify the modeling approaches as the algorithms are developed.

This process can therefore require substantial time and interaction between the model developers and the vendors. In some cases, delays in starting to work with vendors may occur due to current commitments. Some of the above requested data may not be available for a stormwater control being considered for inclusion in WinSLAMM. If this occurs, we make conservative performance assumptions when developing the model algorithms. Interested vendors should submit their available data for our review as the first part of the contracted work to indicate if there are any major short-comings and if there are suitable options or alternatives.