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Technical Memorandum

Prepared for: Maryland-National Capital Park and Planning Commission

Project Title: Limited Amendment to the Clarksburg Master Plan

Subject: Draft Response to September 9, 2013 Geosyntec Letter

Date: October 15, 2013

To: Mary Dolan and Valdis Lazdins, Montgomery County Planning Department

From: Biohabitats and Brown and Caldwell, a Joint Venture

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This document was produced solely for the purpose of the discussions referred to in the Joint Stipulation between The Maryland-National Capital Park and Planning Commission and Pulte and is not admissible in any subsequent litigation.

Introduction

The purpose of this technical memorandum is to provide preliminary responses from Biohabitats and Brown and Caldwell, a Joint Venture, to certain technical comments raised by Geosyntec in the letter dated September 9, 2013 to the Montgomery County Planning Board entitled *Clarksburg Master Plan Limited Amendment – Ten Mile Creek Area*.

As an initial matter, it is our understanding that the purpose and scope of the Joint Venture modeling effort was to provide high level (planning level) modeling in conjunction with related assessments to assist the Planning Department in evaluating general impacts of development within the entire Ten Mile Creek watershed area. In this context, the modeling effort was appropriately limited, was based on area-wide assumptions, and its conclusions were consistent with other analyses (summarized in the July 2, 2013 report entitled *Ten Mile Creek Watershed Environmental Analysis in Support of the Limited Amendment to the Clarksburg Master Plan*) in concluding that the Ten Mile Creek Watershed area could be impacted by additional development.

As discussed previously, the planning level modeling approach used accepted modeling techniques along with various assumptions and inputs. More detailed modeling using data inputs representing site-specific conditions may be appropriate as part of a later development review process for a specific site design and stormwater management concept plan review. However, predictions made by any modeling approach will vary from actual post-development conditions due to a variety of factors (e.g., variations in site conditions, stormwater management approach, design parameters, and other variations at individual development sites). This is one of the key reasons that planning scale modeling with a margin of safety was an appropriate tool to use as part of the important land use decisions currently being considered in the Ten Mile Creek watershed.

In addition, although we have not conducted a detailed review of the Geosyntec modeling efforts for Pulte, and we express no opinion concerning the validity of any conclusions contained in its report, it is important to note that Geosyntec's efforts appear to relate only to the specific areas within the watershed (LSTM110 and LSTM111) where we understand Pulte proposes development. In turn, many of the concerns and questions raised by Geosyntec also relate to differences between planning level versus site-specific modeling efforts.

Discussion

For the purposes of this draft response, comments were categorized as those relating to the existing conditions models, and those related to the simulation of environmental site design (ESD). Other comments related to site-specific stormwater management design considerations have been addressed in the Planning Department's previous responses to questions and testimony.

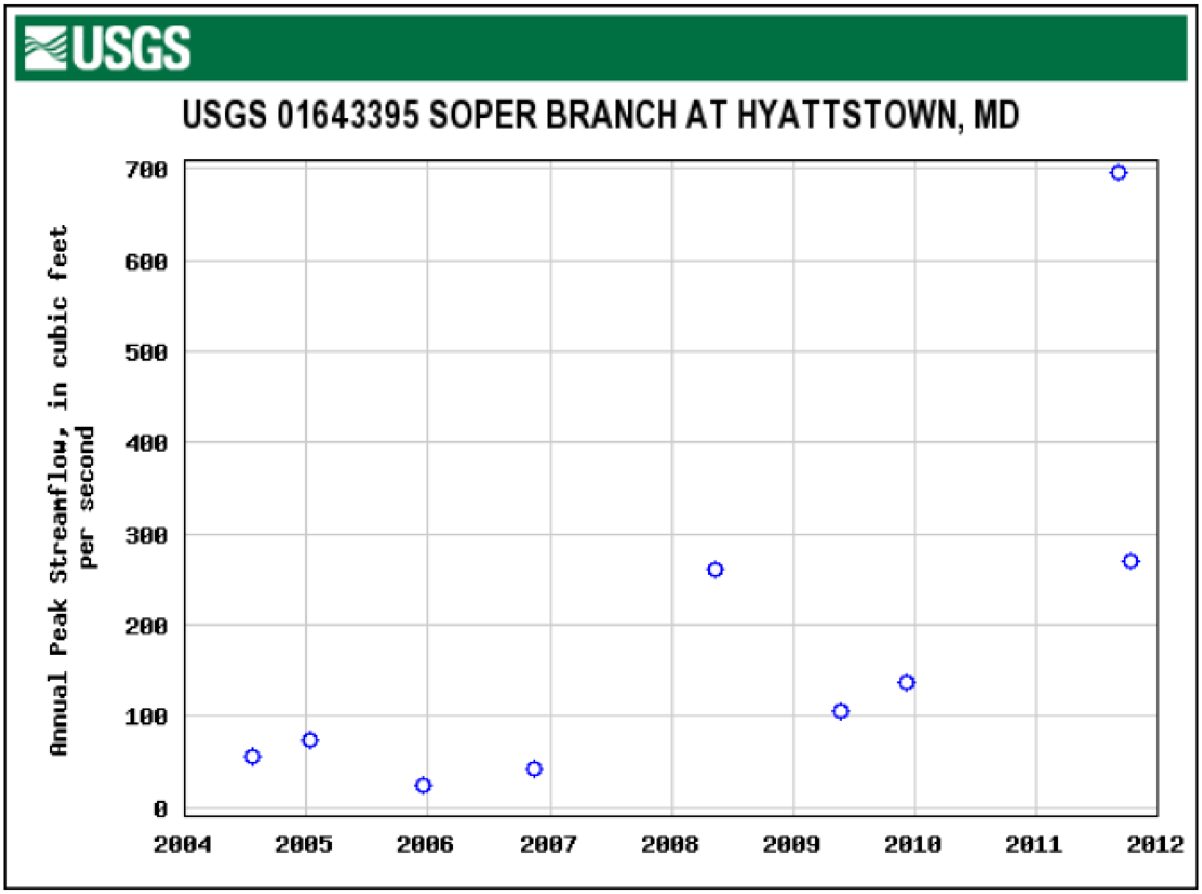
> ***<u>Geosyntec Comment</u>: Existing conditions model results are well outside of independent predicted results and norms for the area….The MNCPPC's consultant's model appears to grossly underestimate peak flow rates in LSTM110 and LSTM111.***
>
> *<u>Response:</u>* We do not agree that the model grossly underestimated existing condition peak flow rates in LSTM110 and LSTM111.. Predicted peak flow rates are sensitive to various model algorithms and parameters, and can vary widely even within the range of accepted modeling methods and parameter values. The actual peak flow rates in LSTM110 and LSTM111 are unknown. Therefore, it is possible to arrive at different modeled predictions of peak flows under existing conditions. The Geosyntec comment letter cites three bases for comparison of predicted peak flows in LSTM110 and LSTM111:

1. USGS regression equations
2. Area-scaled continuous gage data from USGS gage 01644390—Ten Mile Creek Near Boyds, MD
3. Independent SWMM modeling

The USGS Regression Equation quoted by Geosyntec is several years old. USGS has updated the regressions and present data on the USGS stream statistics web site (http://streamstatsags.cr.usgs.gov/md_ss/default.aspx?stabbr=md&dt=130239302542270000). For a basin in the vicinity of the basins in question, this web site suggests a peak 2-yr flow of about 50 cfs for the 211-acre basin 110, which is greater than the value predicted by the Joint Venture but less than the value cited by Geosyntec. The Geosyntec model predicts peak 2-year flows twice the older USGS values and three times the more recent values.

Geosyntec used area-scaling from the Ten Mile Creek gage to validate their model results in continuous simulation noting that their model results were consistent with the area scaled peak flows during Tropical Storm Lee (9/8/2011). This gage is measuring flows from large areas of land use dissimilar to the largely undeveloped land uses found in LSTM110 and LSTM111 and a simple area scaling may be inappropriate. That aside, a better comparison may be achieved if the model outputs were contrasted with the full gage record so that smaller events nearer a one or two year occurrence could be assessed.

Much lower peak flows might be estimated if the area-scaling analysis used data from watersheds more similar in size and characteristics to LSTM110 and LSTM111. For example, the Soper Branch gage near Hyattstown, MD (01643395; (http://waterdata.usgs.gov/nwis/dv/?site_no=01643395&agency_cd=USGS&referred_module=sw) measures streamflows from an undeveloped watershed of about 750 acres. Application of the area-scaling method to this gage would result in peak 2-year streamflow estimates for the 211 acre LSTM110 of 30 to 40 cfs. This estimate was made by taking the 4th largest annual peak flow in the area-scaled 9-year record. This represents a rough estimate because the record is relatively short, but it reflects the characteristics of the watershed. The Soper Branch data are shown below.



Other methods of estimating the existing system peak flows are available. For example, the U.S. Fish and Wildlife Service (McCandless and Everett, 2002) has developed regional regression curves to estimate bankfull discharge and channel geometry for streams in the Maryland Piedmont. Bankfull discharges are relevant to the analysis because they generally correspond to events with a return frequency of 1-2 years (Rosgen, 1996). McCandless and Everett (2002) provide the following equation for estimating bankfull discharges in the Maryland Piedmont:

$$Q_{bkf} = 84.56\ (DA)^{0.76}$$

Where:

Q_{bnk} = bankfull discharge (cfs)

DA = drainage area (mi^2)

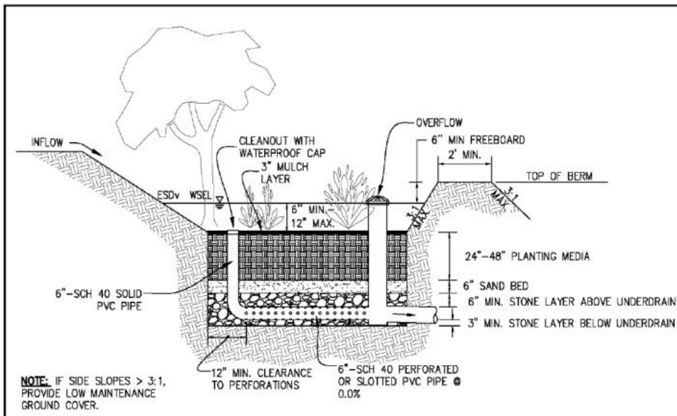
Application of this method to subwatershed LSTM110 and LSTM111 provides bankfull discharge estimates of 36 and 21 cfs, respectively. These values are significantly lower than Geosyntec's estimates of peak flows for the 1- and 2- year storms.

Some of Geosyntec's criticisms of the planning-level model are related to the use of the SCS method and specific runoff curve numbers. The SCS method is a widely-accepted approach for planning level hydrologic modeling, and the curve numbers used in the planning-level model are within the range of published values for the land uses and soil types present. The selection of different infiltration algorithms, parameters, or model configuration would indeed affect the prediction of peak flows. While it can be argued that the existing condition peak flows in the Joint Venture analysis should have been higher for modeling purposes, we are aware of no basis to accept the estimates cited by Geosyntec that are three or more times higher than alternative estimates. Most importantly, even using USGS values, the analysis would still have shown significant increases in peak flows resulting from development.

Geosyntec Comment: ***Infiltration rates do not represent actual soil conditions within the ESD…we do not believe MNCPPC's model is consistent with the descriptions in the MNCPPC Report and does not accurately represent the storage and infiltration occurring within ESD measures.***

Response: Geosyntec is correct that there are inconsistencies between the report and the manner in which ESD practices were actually modeled. However, these inconsistencies do not invalidate the ESD simulation, nor greatly affect the predicted peak flows. The following response clarifies the manner in which the ESD practices were modeled, and why these represent reasonable assumptions for a planning-level modeling analysis.

Future development runoff was estimated using a 100% impervious catchment representing impervious surfaces, and a pervious catchment using the same SCS technique as for the base condition for estimation of infiltration with a larger SCS curve number representing soil disturbance. The reduced undeveloped area was modeled using the same parameters as the existing condition runs. The runoff from these developed catchments was routed to two additional catchments (#4 and #5) to account for ESD controls as described below. The model attempts to simulate the County's micro-bioretention standard as shown below:



MICRO–BIORETENTION
TYPICAL CROSS SECTION
NTS

In these ESDs, storm inflow infiltrates through planting media and is collected in the underdrain for discharge. If the inflow exceeds the infiltration capacity of the planting media then excess flow is stored up to a specified depth before discharging out the overflow-largely bypassing the underdrain media.

Catchment #4 (Ponding Volume)

Runoff from the developed catchments is routed to catchment #4, which represents the volume available for ponding above the planting media. This catchment is configured with a total area equivalent to the expected area according to County standards. It was assumed to be 100% pervious area with Horton Infiltration and depression storage of 9-inches. Infiltration occurs to the planting media and excess flow that cannot infiltrate is stored up to a specified depth. The model specification of a 9-inch depression storage simulates the storage available above the planting media.

The 9-inch depression storage and Horton infiltration parameters were arrived at based on discussions with Montgomery County DPS and through consideration of public comments from previous Montgomery County Planning Board work sessions. The 9-inch depression storage value is the mid-point of the depression storage range noted in the County's Micro-Bioretention standard detail. Maximum and minimum Horton infiltration values were based on published values (Akan 1993) and can be found in the "XPSWMM Technical Reference Manual".

Catchment #5 (Directly Routed to Outlet)

In the model, outflow from catchment #4 was directed to catchment #5 for storage in the planting media and underdrain. As (incorrectly) described in the modeling report, this catchment represented storage in the filter media. As pointed out by Geosyntec, because this catchment was modeled as 100% impervious, no storage or infiltration occurred in catchment #5, and all flow to this catchment was directed to the outlet. This simulates the overflow of water from the ponding area into the outflow pipe as shown on the schematic above. An equivalent result would have been attained by directing the outflow from catchment #4 directly to the outlet.

Inclusion of catchment #5 with 100% imperviousness results in an increase in system outflow volume as noted by Geosyntec, due to the double-counting of rainfall on the ESD area. Once the infiltration and storage capacity of catchment #4 is exhausted, excess flow is directed to catchment #5 in the model where it runs off. This would not appreciably affect peak flow estimates, because the timing of these flows does not coincide with peak runoff flows from catchment #4. Infiltration at the bottom of the ESD in this configuration is simulated by the infiltration in Catchment #4 which is lost from the solution.

In summary, the manner in which catchment 5 was modeled did not greatly affect the peak flow predictions, which are largely controlled by the rate at which water is predicted to overflow the ponding area of catchment #4 into the outflow pipe. Infiltration from the bottom of the ESD is indirectly simulated by the infiltration in catchment #4. In permitting ESD, the County's assumption is that the underdrain allows water to freely flow from that structure once it reaches the underdrain. Under this assumption, it would not be proper for catchment #5 to include additional storage to account for water leaving the underdrain and entering the filter media or a stone reservoir. If the ESD practice were designed in a manner to cause the overflow to enter the stone reservoir (below the underdrain) prior to entering the underdrain, it would be appropriate to simulate the effect of some storage in the stone reservoir.

Conclusion:

The Joint Venture conducted its modeling for the Limited Master Plan using widely-accepted industry practices. The modeling approach, model parameters and assumptions were developed in collaboration with the Planning Department, Department of Environmental Protection (DEP) and Department of Permitting Services (DPS) to represent average watershed-wide conditions, as is appropriate for planning-level land use evaluations. Although Geosyntec questions the modeling results, model simulations are sensitive to selected algorithms and parameters, and model predictions may vary widely even within the range of accepted modeling methods and parameter values. And even if the Joint Venture estimate of existing condition peak flows had been higher based on USGS estimates, the analysis would still have shown a significant increase in post-development peak flow using the County's standard ESD details. Importantly, in concluding that the Ten Mile Creek Watershed could be impacted by additional development, the results of the Joint Venture modeling were consistent with the other environmental analyses and conclusions conducted and provided in support of the Limited Amendment to the Clarksburg Master Plan. .

References

Akan, A. O., 1993. Urban Stormwater Hydrology - A Guide to Engineering Calculations, Technomic Publishing Co., Lancaster, Pennsylvania, 1993, ISBN: 0-87762-966-6.

McCandless, T. and Everett, R. 2002. *Maryland Stream Survey: Bankfull Discharge and Channel Characteristics of Stream in the Piedmont Hydrologic Region*. U.S. Fish & Wildlife Service Chesapeake Bay Field Office. CBFO-S02-01.

Rosgen, D.L. (1996). *Applied River Morphology*. Wildland Hydrology Books, Pagosa Springs, Colo.

XP Solutions, Inc. 2012. XPSWMM Reference Manual. 1049 p.