Memorandum

To: *South Carolina Department of Natural Resources (DNR)*
South Carolina Department of Health and Environmental Control (DHEC)

From: *CDM Smith*

Date: *June 3, 2015*

Subject: *User-Based vs. Permit-Based SWAM Modeling*

For a select few of the municipal water user objects in the Saluda SWAM model, available withdrawal data includes both water used directly by that water user and water sold to other major municipal water users (who are included as separate objects in the model). For example, permit #23WS002, associated with the City of Greenville water user object, includes water sold to the City of Easley (Easley Combined Utilities), as well as water used directly by Greenville (and other smaller towns included under the Greenville object umbrella in the model). We have two options for representing these conditions in SWAM. There are advantages and disadvantages to both, and for the majority of water user objects in the models this won't be an issue. However, it is important to select the right approach now, to best meet the needs of future model users, which will include DNR, DHEC, water utilities, and other stakeholders. The two options are discussed briefly below.

Option A: Permit-based construct with lumped withdrawal data, organized by individual permit

Under this option, we would use the total withdrawal data provided by DHEC as the basis for quantifying demands associated with water user objects. There would be no disaggregation of this data to account for water that is withdrawn by **User A** (e.g. Greenville) but sold to **User B** (e.g. Easley). For future uses of the model, total permitted withdrawals could be easily changed on a permit by permit basis. However, the demands for this water (presumably driving those permit changes) would require some pre-processing work to modify in SWAM. In the given example, the user would need to calculate a net demand change for the lumped Greenville water user as a function of changes in both Greenville and Easley water usage. Discharges (return flows) associated with the lumped withdrawal would also need to be disaggregated and assigned to multiple return flow locations in the model. Lastly, any changes to sources of supply for these two cities would also need to be considered, external to the model. The mechanistic link in the model between total water demands and options for sources of supply gets partially lost for this type of representation. In summary, the model becomes slightly less *predictive* and slightly more *prescriptive* under this option. However, it may be a more useful representation for DNR and DHEC – particularly for permitting support.

Option B: User-based construct with prescribed total water user demands, organized by water user

Under this option, we would disaggregate withdrawal data where multiple water user objects are served by a single permit (through water purchases/sales). The amount of water ultimately used by **User B** would be subtracted from the total withdrawals associated with the lumped **User A** permit and assigned as part of the total **User B** demand. For example, the water sold by Greenville to Easley would be subtracted from the Greenville permit #23WS002 and, instead, included in the water usage values prescribed for Easley. The Easley object would also have an additional source of supply included in its supply portfolio, representing the withdrawal under permit #23WS002.

The advantage of this approach is that it maintains an accurate representation of total water demands/usage associated with a given water user object. In addition to making the model more intuitive to the user, this will better facilitate future planning simulations of the model. For example, any model simulations involving increased future municipal demand projections will be easier to set up and interpret if total demands are included in single water user objects, rather than distributed among multiple user objects. In our example, Easley and Greenville total demands could simply be adjusted within the user objects themselves rather than requiring pre-processing work to figure out how much the demand for purchased water will change as a function of the total demand change. Under this approach, the mechanistic power of the model to satisfy a total water user demand using multiple sources of supply, as needed, is fully retained. Lastly, return flow locations would also likely be easier and more intuitive to define, compared to the permit-based approach, since they will correspond to the discharge location(s) associated with a single water user object.

The disadvantage of this approach is that the withdrawal permits associated with these conditions would be somewhat disaggregated in the model. Changes to a single permit limit, for example, would need to be applied for multiple users in the model. Therefore, for some simple permitting simulations of the model, this option may be less desirable.

Note to reader: It was agreed upon by DNR and DHEC that Permit-Based SWAM Modeling will be used.