Documentation for the DRAFT Connecting Watersheds to Tidal Water Quality Tool

Tool Link: https://gis.chesapeakebay.net/watershedinfluenceonbay/

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I. Purpose
   a. Designed to serve as a visualization supporting one component of the tiered implementation discussion, this tool answers the question "For a given estuarine segment, what is the total upstream influence on water quality (using chlorophyll-a as a proxy) and which watersheds contribute to the segment's water quality?".
   b. This is a draft tool and under continual development. At this stage, it is only meant to drive discussion and help visualize a component of the broader question on tiered implementation. It should **not** be used for making decisions at this point in time.

II. Methods
   a. The values displayed in this visualization come from a set of geographic isolation runs conducted using the Phase 6 suite of models in 2019. The 2017 Progress scenario was used as the baseline. Different from the set of geographic isolation runs conducted in 2017 for the Mid-Point Assessment, this was accomplished by increasing Total Nitrogen (TN) by 5 million lbs and Total Phosphorus (TP) by 500,000 lbs for point sources and non-point sources in isolation. This resulted in a series of four runs for each of the 92 segments.
      i. Note: previously it was stated that the increase used was 1 million lbs for TN and 100,000 lbs for TP, which was used in the geographic isolation runs to calculate Deep Water/Deep Channel relative effectiveness for dissolved oxygen. This was a mistake. For the purposes of these runs, a larger signal was used after testing other thresholds.
   b. This visualization uses chlorophyll-a as a proxy for water quality. The estuarine scientists consulted to interpret these geographic isolation runs in 2019 found the dissolved oxygen results to be unsuited to this particular task. Since chlorophyll-a is an indicator of primary productivity and the results were more straightforward to interpret, this visualization considers influence on water quality to be the chlorophyll-a concentration in nanograms per liter that a given segment-shed causes in a selected segment.

i. For this visualization, the influence on chlorophyll-a was normalized to make it easier for users to interpret, resulting in the percentage values in the tool.
ii. Since there are not numerical chlorophyll-a criteria throughout the 92 segments, the influence is based on absolute contributions to concentration. This means that segments within an ecologically healthy range are not differentiated from those above that range in this visualization.

III. Notes
a. Watersheds are only included in the dashboard if their influence on a given segment is greater than 1% of the total effect on that segment. This was done to keep the visualization cleaner.
b. While the term watershed is used in the visualization, we are referring to the concept of "segment-sheds", the part of the watershed which drains directly to that estuarine segment.
c. The main Bay segments aren't included in this visualization because the focus was on tributaries and shallow waters.
d. There are a few segments which were left out of the visualization because they either 1) were not fully resolved in the Phase 6 suite of models or 2) the unique shape of their segment made them unsuitable for this exercise of identifying what should be considered upstream of their segment.

IV. Limitations
a. These numbers are based on a single set of runs (which we know has at least one mistake) from the Phase 6 models, so with Phase 7 models these values are going to change. We don't know how much they will change.
b. These methods haven't gone through formal peer review, so it's possible that could reveal additional issues once we have numbers from Phase 7 models down the road. For example, estuarine scientists may have insights about how to better interpret Dissolved Oxygen results so that we can use those values directly.

V. Plans for a New Set of Runs Using the Phase 7 Suite of Models
a. Conduct the geographic isolation runs with a more recent progress scenario year.
b. Investigate methods for better representing and including the tidal water quality segments not represented in the P6 viewer.
c. Corroborate results with other lines of evidence (monitoring data, inert tracers, and other scientific studies).
d. Conduct a more rigorous peer review process.