

## Accounting for Growth Calculator

The accounting for growth calculator provides offset estimates of nitrogen and phosphorus based upon geographic location within the Bay watershed, pre-development landuse assumptions, post-development landuse assumptions and type of sewage treatment. The calculator uses information from the Chesapeake Bay Partnerships Phase 5.3.2 watershed model, which is the most recent model version and was used to develop the Maryland Phase II Watershed Implementation Plan. Four offset options are evaluated

- Zero allocation baseline
- Forest baseline
- Bay TMDL allocation baseline
- Prior landuse baseline

Offset calculations include both edge of stream loads and delivered loads, and are presented as pounds required to offset per household per year.

### Delivery Factors

Delivery factors are the same as those applied in the Phase 5.3.2 Chesapeake Bay Model scenarios. Delivery factors differ by land-river segment. In the tool, if one particular land-river segment is not identified as the location of the development site, then the delivery factors are averaged (without area weighting) across the chosen land-river segments.

### Loading Rates

Loading rates and scenarios are results directly from the Chesapeake Bay Partnerships Phase 5.3.2 Chesapeake Bay community model scenario output. This is the most recent version of the model and was used to develop the Phase II Watershed Implementation Plans.

Edge-of-stream loads and acres are geographically aggregated to statewide or to major basin and by landuse groups (e.g., crop, pasture, impervious, pervious). Then the aggregate loads are divided by the land area to compute the loading rates.

The Crop landuse is a combination of alfalfa, hightill without manure, hightill with manure, hay without nutrients, hay with nutrients, lowtill with manure, nutrient management alfalfa, nutrient management hightill with manure, nutrient management hightill without manure, nutrient management hay, and nutrient management lowtill. Developed impervious land is a combination of nonregulated impervious developed, and regulated impervious developed.

Developed pervious land is a combination of nonregulated pervious developed, and regulated pervious developed.

Hay is hay without nutrients applied and represents a fallow condition.

Natural forest is forest (in other words excludes harvested forest).

Pasture is a combination of pasture with nutrient management, pasture without nutrient management and degraded riparian pasture.

### **Pre-Development Load & Allocation**

Existing load of pre-development site is calculated using 2010 Progress scenario. The 2010 progress scenario is based on the year 2010 landuse, animal estimates and best management practices. The resulting loads are average annual loads that represent the average load over a 10 year rainfall period.

Allocation condition of pre-development is calculated using 2025 WIP scenario. This scenario represents the load required to meeting Bay water quality. Local non-tidal TMDLs are not included in the tool in the calculation of the baseline Option 3. The resulting loads are average annual loads that represent the average load over a 10 year rainfall period.

### **Post-Development Load**

Post-development load is calculated as:

$$\begin{aligned} & [(\% \text{ impervious})(\text{impervious No Action loading rate}) \\ & + (\% \text{ pervious})(\text{pervious No Action loading rate})](1 - \text{ESD reduction})(\text{site area}) \\ & + (\% \text{ forest})(\text{forest loading rate})(\text{site area}) \end{aligned}$$

ESD reduction is applied as 50% reduction of nitrogen and 60% reduction of phosphorus. This is the ESD efficiency applied in the Chesapeake Bay Partnership model.

### **Residential Wastewater, Septic**

The default reduction for a BAT system is 50%, which is the approved reduction in the Phase 5.3.2 Chesapeake Bay Model.

Septic pass-through, or delivery from edge of septic field to edge of stream, is 80% in the critical area, 50% within 1000ft of a perennial stream and outside of the critical area, 30% outside of 1000ft of a perennial stream, and 42.5% as a statewide average.

The household septic load is calculated as:

$$(8.82 \text{ lb/person/yr})(2.63 \text{ person/household})(\text{septic pass through})(1 - \text{BAT reduction})$$

The 8.82 lb is from CBP documentation. The figure of 2.63 persons is from the 2010 census.

### **Residential Wastewater, Sewer**

Sewered household load is calculated as:

$$\text{WWTP discharge concentration} \times 0.6$$

The 0.6 multiplier is based on a ratio of discharge concentrations from WWTP and septic. This method assumes for WWTP a flow equal to Septic edge of field flow. The assumed flow inherent in the calculation is 195 gal/day/household.

The calculation is as follows:

WWTP EOS Load =  
(Septic EOF Load / Septic EOF Concentration) x WWTP EOS Concentration

The septic EOF load is calculated as:

(8.82 lb N EOF / person / yr) x (2.63 persons / household)

The 8.82 lb is from CBP documentation. The figure of 2.63 persons is from the 2010 census. The septic concentration from CBP documentation is 39 mg/l nitrogen concentration at edge of septic field. The calculation is simplified to a 0.6 multiplier (8.82 x 2.63 / 39).

### **Commercial Wastewater**

Sewered load for commercial properties is calculated based on property type, square footage, and WWTP discharge concentration. The flow value per property type is obtained from:

[http://www.mde.maryland.gov/programs/permits/watermanagementpermits/waterdischargepermitapplications/documents/wastewater\\_design\\_guidelines\\_2012.pdf](http://www.mde.maryland.gov/programs/permits/watermanagementpermits/waterdischargepermitapplications/documents/wastewater_design_guidelines_2012.pdf)

### **WWTP Discharge Concentrations**

The concentrations used for sewered load calculations are:

ENR	4 mg/l TN	0.3 mg/l TP
BNR	8 mg/l TN	3 mg/l TP
Secondary Treatment	18 mg/l TN	3 mg/l TP

### **Instructions for the Calculator**

Four residential examples are already entered on the worksheet, and another column is provided for “User Defined Scenario.” There is also one column for a non-residential development. The user can enter values on the “Calculation” worksheet in any of the yellow cells. Where there are limited options, the yellow cell contains a drop down menu. Here are step-by-step instructions for using the spreadsheet.

1. Go to the “Delivery Factor” worksheet; click on the drop down menus in cells B7, C7, D7, and E7 one at a time, each time selecting “(All).”
2. Still on the Delivery Factor worksheet, using the dropdown menus again, choose one of the 5 major basins, the County, and the 8-digit watershed. If you wish, select a Land River Segment. If you do not enter a Land River Segment, the calculator will use the average of the segments in that 8-digit watershed.
3. Go back to the Calculation worksheet and, using the drop down menu from “Select Loading Rate Geography” (cell C3), select the same major river basin you selected on the Delivery Factor worksheet.
4. On the Calculation worksheet, confirm that the correct basin, county, and watershed appear in “Delivery Factor Defined in Prior Worksheet.”(cells E3, F3 and G3). If they do not, go back to step 1.
5. On the Calculation worksheet, enter the acres of each landuse in the “Pre-Developed Site” box (cells C7 through C12).

6. A. For residential development, on the Calculation Worksheet, in the Post-Developed Site box, enter the number of dwelling units per acre (cell I17) and the percent of the land in the development parcel that will be impervious and pervious (cells I19 and I20). Select from the dropdown menu in cell I22 for the appropriate wastewater treatment.

B. For commercial development, on the Calculation Worksheet, in the Post-Developed Site box, enter the square footage (cell J17), the type of commercial property (J18), and the percent of the land in the development parcel that will be impervious and pervious (J19 and J20). Select from the dropdown menu in J22 for the appropriate wastewater treatment.

7. The calculated numbers appear.

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