

**Guidance for Using the Maryland Assessment Scenario Tool  
to Develop Stormwater Wasteload Allocation Implementation  
Plans for Local Nitrogen, Phosphorus, and Sediment Total  
Maximum Daily Loads**



**- FINAL -  
June 2014**

## **Introduction**

This document provides Maryland's local jurisdictions with recommendations on how to use the Maryland Assessment and Scenario Tool (MAST) to develop Stormwater Wasteload Allocation (SW-WLA) implementation plans for local nutrient and sediment Total Maximum Daily Loads (TMDLs). MAST is one option/tool available for local jurisdictions to use when developing SW-WLA implementation plans. For permitted Phase I municipal separate storm sewer system (MS4) jurisdictions, SW-WLA implementation must be addressed as part of their permit required restoration plans. Although the intent of this document focuses on the use of MAST by Phase I MS4s for developing SW-WLA implementation plans, most of the technical recommendations outlined here could also be applied in creating implementation plans for SW-WLAs and urban LAs assigned to other regulated stormwater dischargers and non-MS4 jurisdictions.

This guidance document describes the Maryland Department of the Environment's (MDE) recommended approach for using MAST to create SW-WLA implementation plans. It is important to emphasize that both the use of MAST and the methodology described herein are recommendations. Local jurisdictions may use other technically sound and acceptable models and approaches to develop SW-WLA implementation plans to best address their needs.

MAST is a web-based nutrient and sediment load estimator tool that is consistent with the Chesapeake Bay Program's (CBP) modeling framework. It was created to streamline and facilitate the development of TMDL watershed management plans. The tool is used for building management scenarios, as well as providing initial estimates of nitrogen, phosphorus, and sediment load reductions from user specified implementation practices. General information about how MAST works and what it can do are further described in the "Help" section of the website. The web address for the tool is: <http://mastonline.org/>.

The following steps describe one potential method for using MAST to develop implementation strategies for achieving local nutrient and sediment TMDL SW-WLAs.

### **I. Translating a TMDL target loads into a MAST-compatible target load**

Because all of Maryland's approved local nutrient and sediment TMDLs were developed using watershed models other than MAST, the baseline and target loads from these TMDLs need to be translated into MAST loadings. This adjustment is required to account for potential differences between models. This is a two step process that involves 1) creating a MAST scenario that replicates the baseline year of the TMDL, and 2) applying the load reduction percentage from the TMDL to the MAST loading for the baseline year.

Before creating any new MAST scenarios, local jurisdictions need to gather necessary background information and perform calculations outside of MAST in order to accurately estimate nutrient and sediment load reductions. This background information can be

gathered from MDE's TMDL Data Center website (<http://www.mde.state.md.us/programs/Water/TMDL/DataCenter/Pages/index.aspx>) (MDE 2014) or from the applicable TMDL reports and documentation. The following bullets describe the specific steps that local MS4s need to take before taking any action in MAST:

- 1) **Determine if the applicable TMDL was written at an Maryland 8-Digit (MD 8-Digit), or similar, watershed scale:** If the TMDL was written at a different scale, another tool, such as BayFAST, might be more appropriate for developing the SW-WLA implementation plan
- 2) **Find the Baseline Year:** Determine the year/conditions associated with the baseline load estimate for the applicable TMDL
  - a) The WLA query function on MDE's TMDL Data Center website includes information on the year(s) associated with the baseline conditions for individual TMDLs/WLAs.
- 3) **Find the load reduction required to meet the SW-WLA:** Determine the SW-WLA reduction percentage from the baseline load estimate specific to the applicable MS4
  - a) The required reduction percentage can be gathered from the TMDL documentation or the WLA query tool on MDE's TMDL Data Center webpage. If this reduction percentage is not directly specified in the TMDL documentation, or MDE's TMDL Data Center, there is likely a complication with determining an exact baseline load for a particular source/jurisdiction. If this is the case, contact MDE (see TMDL Data Center website contact information). Once the baseline load and required reduction percentage have been determined, MAST scenarios can be created to estimate nutrient and sediment load reductions for expected management actions.
- 4) **Calculate the SW-WLA target in terms of MAST loadings**
  - a) Navigate to MAST online, and once logged in, do the following:
    - i) Under the *Scenarios* menu, select *Compare Scenarios* (see Figure 1)
    - ii) For the *Geographic Scale*, select the *HUC 8 with County Split* scale (see Figure 2)
    - iii) For the *Geographic Area*, select your watershed-county (*HUC 8-County*) unique combination (see Figure 2)
    - iv) For *Scenario 1*, select the scenario that corresponds to the applicable TMDL's baseline year (see Figure 2)
      - (1) For example, if the applicable TMDL's baseline load year is 2005, select the *2005 Local TMDL Base*. All of the 2000 – 2008 scenarios that have been added to MAST, so that local jurisdictions could apply them in developing implementation plans for local TMDLs, have the suffix "Local TMDL Base".
    - v) For *Scenario 2* and *Scenario 3*, select any other scenario of interest (any scenario can be selected here since it will have no effect on the final result, but a scenario must be chosen for Scenarios 2 and 3) (see Figure 2).

- vi) Check “Compare to allocations”. Checking that option allows you to compare to the 2025 WIP load. Since those WIP allocations did not differentiate between pervious and impervious, you will not be able to see the urban loads for your baseline year as separate loadings for pervious and impervious land uses (see Figure 2).
- vii) For *Load Type*, select *Landuse*, then click on the *Compare* button (see Figure 2)
- viii) A new page will appear presenting loading results for the selected scenarios. Find the urban sector loads and expand the results of the loadings for the applicable SW-WLA pollutant (nitrogen, phosphorus, or sediments) (see Figure 3)
- ix) Next, find and record the individual urban sector edge-of-stream (EOS) loads (e.g., County Phase I/II MS4<sup>1</sup>) for the baseline year scenario (see Figure 3).
  - (1) Some MAST scenarios identify non-regulated urban acres in Phase I MS4 jurisdictions. These scenarios are incorrect. These non-regulated urban acres should be considered regulated, and they should be associated with the county Phase I MS4 permit. Therefore, any non-regulated urban loads within in a Phase I MS4 county in a MAST scenario should be added to the county’s Phase I MS4 load.
- b) Once the individual urban sector loads have been recorded or downloaded from this page using the download link button under each table, perform the following calculations outside of MAST:
  - i) Apply the reduction percentage from the previous section (Step I.(3)(a)(i)) to the summed impervious/pervious loads to calculate the SW-WLA target load from MAST
    - (1) This is the target that must be achieved by the MAST BMP strategy scenario. This target will differ from the SW-WLA in the TMDL documentation or on the TMDL Data Center website.

## **II. Developing Implementation Scenarios**

The previous series of steps enabled local jurisdictions to determine their SW-WLA target in terms of MAST loadings. This allows jurisdictions to create BMP strategy scenarios that can be compared to an applicable target, in order to assess SW-WLA achievement. The next series of steps describes how to develop the actual BMP strategy scenario in MAST.

---

<sup>1</sup> For the 2010 and 2011 scenarios in MAST, there are non-regulated urban impervious and pervious land-use acres in MS4 counties. This is not correct based on current MDE SW-WLA methods, and this was corrected in the 2013 and 2014 scenarios. If using the 2010 and 2011 scenarios in MAST to develop an SW-WLA implementation plan, local Phase I MS4 jurisdictions should account for this non-regulated urban land.

## 1) Develop SW-WLA BMP implementation strategy scenario

- a) Under the *Scenarios* menu, select *Add Scenario* (see Figure 4)
- b) Name the new scenario (*Scenario Name\**) and add a description for the new scenario (*Description\**) (see Figure 5)
  - i) For example, “Cabin John Creek Sediments SW-WLA BMP Scenario 1” and “Planned management strategies and BMPs for achieving the Cabin John Creek sediment TMDL SW-WLA”
- c) In the *Share this scenario with* box, select what other users you want to be able to view your scenario (Does not matter for analysis) (see Figure 5)
- d) For the *Geographic Scale* and *Geographic Area* options, select the same scale and area as was done previously when determining the MAST target (see Figure 5)
- e) For *Initial Conditions Year*, select the most appropriate watershed model, progress scenario year. This might be the most up-to-date progress year, but it could be the year when the MS4 permit was issued. This will provide the best estimate of current BMP implementation in the TMDL watershed. Ignore the statement in MAST that says “Use 2010 for all WIP scenarios. Use same year as your scenario for Milestone or Progress scenarios”. This is only applicable to scenarios being developed for the Bay TMDLs/WIPs (see Figure 5).
  - i) For example, if a local jurisdiction were putting together their scenario/implementation plan in 2013, and the watershed model 2013 progress scenario was available and has been input into MAST, select “2013”
- f) For *Processed Water Base Data* and *Combined Sewer Overflow Connections*, select “Cap Loads” and “2025 WIP”, respectively, since these represent known implementation levels for these sectors (see Figure 5)
- g) The next option allows the user to select between using either *Chesapeake Bay Program approved BMPs only* or *All BMPs, including Maryland specific*. Select *All BMPs, including Maryland specific*, since this allows the user to input BMPs that the jurisdiction may intend to implement, and should be credited for relative to meeting local TMDL SW-WLAs, but the Chesapeake Bay Program has not approved yet, and for which credit cannot be given relative to meeting the Chesapeake Bay TMDLs (see Figure 5).
- h) In the *Copy BMP data from another scenario*, select *choose one scenario for all source sectors*. Then, a drop down menu titled *All BMPs* will appear. Select the progress scenario from the drop down list that corresponds to the year selected for the *Initial Conditions Year*, then click the *Add* button (see Figure 5)
  - i) For example, if you set your *Initial Conditions Year* to “2013”, in the *All BMPs* drop down list, select “2013 Progress”
- i) A new screen will then appear which will display the current BMP implementation levels in the watershed. At this point, the user should begin to edit/add to the BMP implementation levels as desired (see Figure 6)
- j) When BMPs are at desired level, select *Calculate Summary* from the top menu. This will provide the user with a summary of loads associated with the new BMP scenario (see Figure 7).

- k) Under the Calculate Summary menu, the user may select the Download Files option to download the BMPs and/or the loads estimated.
- l) Outside of MAST, the user should now record the results of the pollutant load summary and compare the results to the MAST SW-WLA target that was calculated in Step I.(4)(b)(ii). This will require summing up the pervious and impervious urban land uses.
- m) If the MAST SW-WLA target is not met, iteratively go back and refine the BMP implementation levels until the target is achieved

### **MAST Updates**

Appendix A of MDE's guidance document, *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* identifies MAST as one of several models that can be used to develop implementation plans for meeting SW-WLAs. It is available online for all users at no cost, is based off CBP's modeling framework, and has already been used for this purpose. Jurisdictions in Maryland used MAST to create scenarios that were used to inform its watershed implementation plan (WIP) for the meeting Chesapeake Bay TMDLs.

Local jurisdictions that use MAST to develop SW-WLA plans should keep in mind that MAST is continually updated to reflect CBP modeling protocol and procedures. These changes will reflect a better understanding of environmental nutrient and sediment dynamics; however any jurisdictions that choose to use this model may need to revise targets and scenarios with these ongoing refinements. For example, following the adoption of the Phase 6 Chesapeake Bay Watershed Model, MAST will be significantly updated. This will probably occur in 2017 or 2018, and pollution targets and implementation plans that were developed using previous versions of MAST should be revisited at this time to determine if changes are needed. A record of all changes to MAST is recorded under the Upgrade History link in the footer of every page on MAST.

### **References**

Maryland Department of the Environment (MDE). 2013. Maryland TMDL Data Center. <http://www.mde.state.md.us/programs/Water/TMDL/DataCenter/Pages/index.aspx> (Accessed March, 20).

## Figures

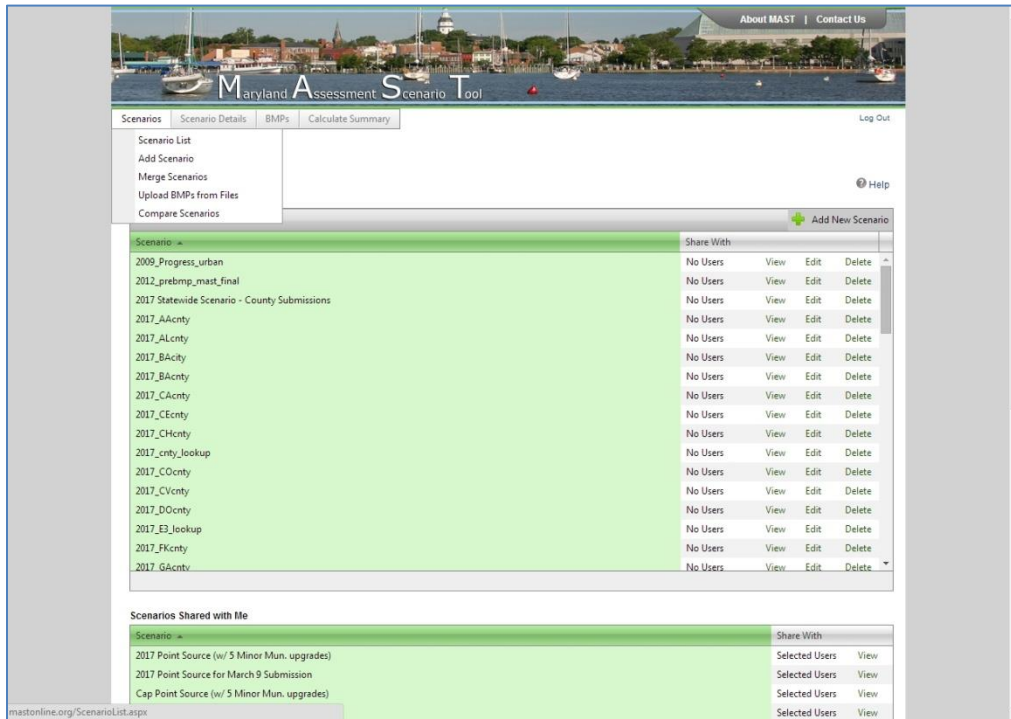


Figure 1: Compare Scenarios

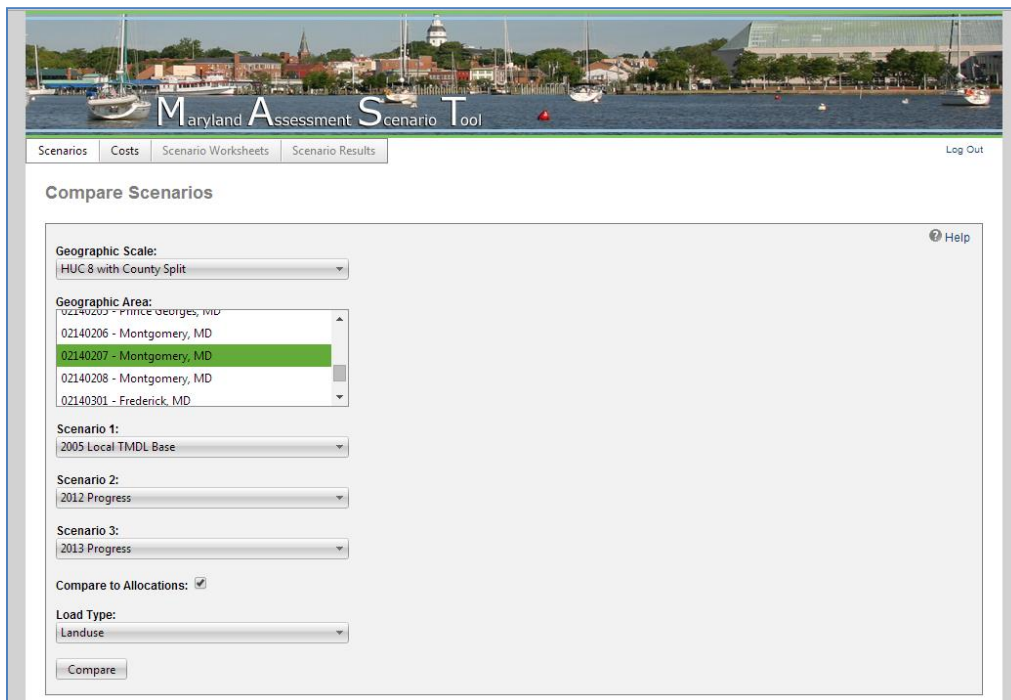
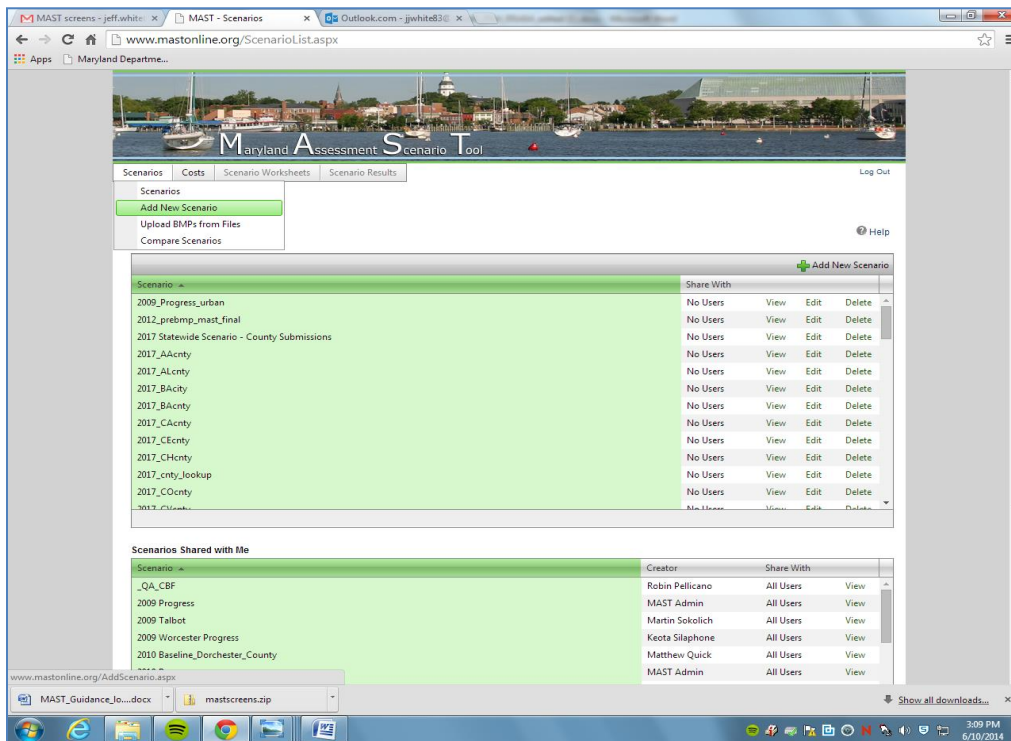


Figure 2: Selecting Parameters for Compare Scenarios

Nitrogen Landuse Loads (lbs)									
Landuse	2005 Local TMDL Base (Edge of Stream)	2012 Progress (Edge of Stream)	2013 Progress (Edge of Stream)	Allocation (Edge of Stream)	2005 Local TMDL Base (Delivered)	2012 Progress (Delivered)	2013 Progress (Delivered)	Allocation (Delivered)	
<b>Sector: Agriculture</b>									
	355.4	242.6	246.7	282.2	139.9	95.5	97.1	111.1	
<b>Sector: Forest</b>									
	18,601.5	17,682.3	18,081.9	17,617.4	7,320.8	6,959.0	7,116.3	6,933.5	
<b>Sector: Urban</b>									
Combined Sewer Systems Land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Construction	15,699.7	19,355.3	14,194.0	20,278.0	6,178.8	7,617.5	5,586.2	7,980.6	
County Phase I/II MS4	200,774.4	185,349.8	182,403.9	172,253.0	79,016.8	72,946.3	71,786.9	67,791.9	
Extractive	701.2	619.6	619.6	557.2	276.0	243.8	243.8	219.3	
Federal Developed	36.1	30.8	32.0	29.1	14.2	12.1	12.6	11.5	
Municipal Phase II MS4	50,636.6	38,778.8	40,777.0	36,168.0	19,928.5	15,261.8	16,048.2	14,234.3	
Non-regulated	0.0	0.0	0.0	111.2	0.0	0.0	0.0	43.8	
Regulated Industrial Facilities	385.5	304.2	279.2	282.7	151.7	119.7	109.9	111.3	
SHA Phase I/II MS4	20,853.9	15,807.8	13,846.6	14,699.0	8,207.3	6,221.3	5,449.5	5,784.9	
State Phase II MS4	486.7	411.4	395.1	385.7	191.5	161.9	155.5	151.8	
	289,574.0	260,657.8	252,547.4	244,763.9	113,964.7	102,584.5	99,392.6	96,329.3	
<b>Sector: Water</b>									
	139.4	102.4	102.4	102.4	54.9	40.3	40.3	40.3	
<b>Total Lbs:</b>	<b>308,670.2</b>	<b>278,685.1</b>	<b>270,978.3</b>	<b>262,765.9</b>	<b>121,480.3</b>	<b>109,679.3</b>	<b>106,646.2</b>	<b>103,414.2</b>	

**Figure 3: Finding Applicable loads in Compare Scenarios Function**



**Figure 4: Select Add a New Scenario**



**Maryland Assessment Scenario Tool**

Scenarios | Costs | Scenario Worksheets | Scenario Results | Log Out

### Add New Scenario

\* required fields

Scenario Name\*: Cabin John Creek Sediments SW-WLA BMP Scenario 1

Description\*: Planned management strategies and BMPs for achieving the Cabin John Creek Sediment IMDL SW-WLA

Initial Conditions Year\*: 2013  
(Use 2010 for all WIP scenarios. Use same year as your scenario for Milestone or Progress scenarios.)

Processed Water Base Data\*: Cap Loads

Combined Sewer Overflow (CSO) Connections\*: 2025 WIP2

Cost Profile\*: Maryland Default Costs

Share this scenario with:  No Users  All Users  Selected Users

Geographic Scale\*: HUC 8 with County Split

Geographic Area\*:  
 02140205 - Montgomery, MD  
 02140205 - Prince Georges, MD  
 02140206 - Montgomery, MD  
 02140207 - Montgomery, MD  
 02140208 - Montanmer, MD

Chesapeake Bay Program approved BMPs only:   
 All BMPs, including Maryland specific:

Copy BMP data from another scenario:  Choose one scenario for all source sectors  
 Choose different scenarios for source sectors

All BMPs: --Please Select a Scenario to Copy--

**Figure 5: Select Parameters for New Scenario**

**Urban Land BMP Worksheet**

Select the BMP you would like to add:

Select the land use or land use group you would like to apply the BMP to:

Select the geographic scale you would like to use to determine the area for the BMP:

Specify which geographic area you would like the BMP applied to:

Enter an amount and select a unit for the BMP:

Notes:

Scenario Attributes | Septic BMPs

### Urban Land Pre-BMP Acres

Landuse	Non-Federal	Federal
County Phase I/II MS4 Impervious	2,398.3	0.0
County Phase I/II MS4 Pervious	8,355.2	0.0
CSS construction	0.0	0.0
CSS extractive	0.0	0.0
CSS impervious developed	0.0	0.0
CSS pervious developed	0.0	0.0
Federal Impervious	0.0	0.3
Federal Pervious	0.0	1.4
Municipal Phase II MS4 Impervious	894.4	0.0
Municipal Phase II MS4 Pervious	1,216.8	0.0
nonregulated extractive	0.0	0.0
nonregulated impervious developed	0.0	0.0
nonregulated pervious developed	0.0	0.0
regulated construction	311.4	0.0
regulated extractive	20.5	0.0
Regulated Industrial Facility Impervious	5.8	0.0
Regulated Industrial Facility Pervious	9.0	0.0
SHA Phase I/II MS4 Impervious	325.7	0.0
SHA Phase I/II MS4 Pervious	372.4	0.0
State Phase II MS4 Impervious	4.0	0.0
State Phase II MS4 Pervious	20.2	0.0
<b>Total:</b>	<b>13,933.7</b>	<b>1.7</b>

Download Landuse

BMP Data Submitted

BMP	Land Use Group	Geography	Unit	Total Amount	Notes	Annualized Cost Per Unit
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

No records to display.

**Figure 6: Add Desired BMPs to Scenario**

Landuse Loads		Info on agreement with the Chesapeake Bay Program's Watershed Model						
Landuse	Pre-BMP Acres	Post-BMP Acres	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered	Lbs Phosphorus Edge of Stream	Lbs Phosphorus Delivered	Lbs Sediment Edge of Stream	Lbs Sediment Delivered
> Sector: Agriculture	8.8	8.8	303.4	119.5	32.8	15.4	17,456.3	11,309.8
> Sector: Forest	2,470.7	2,470.7	14,791.0	5,821.2	294.9	138.4	445,665.1	288,743.5
> Sector: Urban								
County Phase I/II MS4 Impervious	2,398.3	2,398.3	44,773.5	17,621.1	4,223.8	1,981.5	3,376,671.0	2,187,722.5
County Phase I/II MS4 Pervious	8,355.2	8,355.2	145,631.3	57,314.7	3,556.1	1,668.3	2,968,527.8	1,923,289.3
CSS construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CSS extractive	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CSS impervious developed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CSS pervious developed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Federal Impervious	0.3	0.3	9.8	3.9	1.0	0.5	792.7	513.6
Federal Pervious	1.4	1.4	28.0	11.0	0.6	0.3	510.1	330.5
Municipal Phase II MS4 Impervious	894.4	894.4	25,676.1	10,105.1	2,517.5	1,181.0	2,073,136.9	1,343,171.5
Municipal Phase II MS4 Pervious	1,216.8	1,216.8	21,208.0	8,346.6	517.9	242.9	432,300.8	280,084.8
nonregulated extractive	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nonregulated impervious developed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nonregulated pervious developed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
regulated construction	311.4	311.4	18,363.3	7,227.1	3,232.3	1,516.4	3,927,630.8	2,544,685.8
regulated extractive	20.5	20.5	619.6	243.8	108.7	51.0	116,049.0	75,187.4
Regulated Industrial Facility Impervious	5.8	5.8	165.2	65.0	16.2	7.6	13,336.6	8,640.7
Regulated Industrial Facility Pervious	9.0	9.0	157.4	62.0	3.8	1.8	3,209.0	2,079.1
SHA Phase I/II MS4 Impervious	325.7	325.7	9,348.3	3,679.1	916.6	430.0	754,801.2	489,030.6
SHA Phase I/II MS4 Pervious	372.4	372.4	6,491.7	2,554.9	158.5	74.4	132,326.2	85,733.2
State Phase II MS4 Impervious	4.0	4.0	116.0	45.7	11.4	5.3	9,368.5	6,069.8
State Phase II MS4 Pervious	20.2	20.2	352.9	138.9	8.6	4.0	7,194.3	4,661.1
	13,935.4	13,935.4	272,941.1	107,418.9	15,273.0	7,165.0	13,815,854.9	8,951,199.9
> Sector: Water	10.9	10.9	102.4	40.3	6.5	3.0	0.0	0.0
<b>Total:</b>	<b>16,425.8</b>	<b>16,425.8</b>	<b>288,137.9</b>	<b>113,399.9</b>	<b>15,607.2</b>	<b>7,321.8</b>	<b>14,278,976.3</b>	<b>9,251,253.2</b>

**Figure 7: Finding Applicable loads in New Scenario**