

ADDENDUM: Updates to *A Methodology for Addressing Sediment Impairments in Maryland's Nontidal Watersheds* for Sediment Total Maximum Daily Loads (TMDLs) developed starting in Fiscal Year (FY) 2009.

1.0 INTRODUCTION

This addendum identifies revisions made to the methodology used for addressing Maryland's nontidal sediment impairments listed on the State's *Integrated Report of Surface Water Quality in Maryland* (MDE 2008). The original methodology report, *A Methodology for Addressing Sediment Impairments in Maryland's Nontidal Watersheds*, describes how the *sediment loading threshold* used for all FY 2006, 2007, and 2008 nontidal sediment TMDLs was developed. The report was originally released for public review as a supporting document during the respective review periods for the individual FY 2006 nontidal sediment TMDLs and was subsequently accepted when submitted to the U.S. Environmental Protection Agency (EPA) as an accompanying document to the TMDLs.

The revisions described within this addendum were made due to the updated biocriteria listing methodology in Maryland's 2008 Integrated Report (MDE 2008) and a revised simplified methodology for calculating the *sediment loading threshold*. Since the original methodology was already accepted by the EPA, the addendum should be viewed together with the original nontidal sediment TMDL methodology report in order to fully understand the sediment TMDL analyses developed in FY 2009 as well as all future sediment TMDLs.

2.0 REVISIONS

2.1 Reference Watersheds

In the original nontidal sediment TMDL methodology report, the reference watersheds were determined based on the 2006 Integrated Report biocriteria listing methodology (i.e., the process by which Maryland Department of the Environment (MDE) assesses biological impairment). Biological assessment was previously conducted in the 2004 and 2006 Integrated Reports using the Benthic and Fish Indices of Biotic Integrity (BIBI/FIBI) from the Maryland Biological Stream Survey (MBSS) dataset at the individual monitoring station and corresponding stream segment scale (MDE 2004, 2006). Individual monitoring station impairment was directly compared to the threshold value of 3.0 (on a scale of 1 to 5) (Roth et al. 1998, 2000; Stribling et al. 1998). In the 2008 Integrated Report, MDE revised its biocriteria listing methodology (MDE 2008). Current, biological impairments are assessed at the 8-digit watershed scale based on the percentage of MBSS monitoring stations, translated into watershed stream miles, that have an Index of Biotic Integrity Score (IBI) < 3 (; MDE 2008).

Due to the revised biocriteria listing methodology and the incorporation of additional MBSS data in the 2008 Integrated Report, the biological assessment for some of the

reference watersheds identified in the original nontidal sediment TMDL methodology report has changed (i.e., watersheds listed as unimpaired for biology in 2006 are now listed as impaired in 2008). Previously, the reference watersheds were not assessed as a whole in the 2006 Integrated Report, and the identification of their average IBI scores at the 8-digit scale and subsequent IBI passing or failing status was solely calculated for the purposes of developing a *sediment loading threshold*. In order to have an accurate *sediment loading threshold* for projects developed post 2008, the reference watershed group was revised so as to reflect sediment loading conditions in those watersheds currently meeting Maryland’s aquatic life criteria. Thus, a revised *sediment loading threshold* was calculated using the updated list of watersheds with healthy biological communities, as identified in the 2008 Integrated Report (i.e., watersheds listed on category 2).

Table 1: 2006, 2007, and 2008 Nontidal Sediment TMDL Reference Watersheds

MD 8-digit Name	MD 8-digit	BIBI Status ¹
Deer Creek	02120202	Pass
Broad Creek	02120205	Pass
Little Gunpowder Falls	02130804	Pass
Prettyboy Reservoir	02130806	Pass
Liberty Reservoir	02130907	Pass
S. Branch Patapsco	02130908	Pass
Rocky Gorge Dam	02131107	Pass
Brighton Dam	02131108	Pass
Town Creek	02140512	Pass
Savage River	02141006	Pass

Note: 1. Reference watersheds determined by average BIBI scores, and subsequent passing or failing biocriteria status, for the entire 8-digit watershed.

Table 2: Post 2008 Nontidal Sediment TMDL Reference Watersheds

MD 8-digit Name	MD 8-digit	Percent stream mile degraded (%)^{1,2}
Deer Creek	02120202	11
Broad Creek	02120205	12
Little Gunpowder Falls	02130804	15
Prettyboy Reservoir	02130806	16
Middle Patuxent River	02131106	20
Brighton Dam	02131108	11
Sideling Creek	02140510	20
Fifteen Mile Creek	02140511	4
Savage River	02141006	7

Notes: ¹Percent stream miles degraded within an 8-digit watershed is based on the percentage of impaired MBSS stations within the watershed (MDE 2008).

²The percent stream miles degraded threshold to determine if an 8-digit watershed is impaired for impacts to biological communities is based on a comparison to reference conditions (MDE 2008).

2.2 Sediment Loading Threshold

In addition to the revision of the reference watersheds themselves, the methodology used to determine the *sediment loading threshold* based on the reference watersheds was also revised, though kept consistent with existing TMDLs. In the FY 2006, 2007, and 2008 nontidal sediment TMDLs, the *sediment loading threshold* was calculated based on the reference watersheds' forest normalized sediment loads using two methods that resulted in approximately the same value. First, using an EPA recommended method, the 75th percentile of the reference watersheds was calculated, assuming an 80% two sided confidence interval. The result was a 75th percentile of 3.6 with the 80% confidence interval ranging from 3.4 to 4.1. Next, logistic regression was used to calculate the threshold by determining the load beyond all forested conditions that maximized the classification of healthy versus impaired watersheds. The resulting value was estimated as 3.7, with an 80% confidence interval of 3.3 to 4.1. Thus, the results of the analyses indicated target values of approximately 3.6 – 3.7 times the *all-forested watershed sediment load* with 80% confidence intervals of 3.3 and 3.4. As an environmentally conservative approach, the lower of the two confidence interval values (3.3) was selected as the threshold to be used in all FY 2006, 2007, and 2008 nontidal sediment TMDLs. Additionally, it was noted that although these more complex methods were used to determine the threshold, the median of the reference watershed group was approximately equivalent to the lower 80% confidence interval of 3.3.

The *sediment loading threshold* for the post 2008 nontidal sediment TMDLs was calculated based on the updated group of reference watersheds via a different methodology applied in the 2006, 2007, and 2008 analyses. The forest normalized sediment load was still applied, but the method of calculating the threshold based on the reference watersheds differed. Instead of taking the 75th percentile with an 80% confidence interval and using logistic regression, both the median and 75th percentile

values of the reference watersheds were calculated. These were found to be 3.3 and 4.2 respectively. Thus, since these values were in close agreement with the more complex methods used to determine the threshold previously, the median value of 3.3 was established as the *sediment loading threshold*, which represented an environmentally conservative estimate as compared to using the 75th percentile. Therefore, the same threshold of 3.3 will be applied in the post 2008 nontidal sediment TMDLs in order to determine the allowable loading for future TMDL analyses.

Table 3: Sediment Loading Threshold Calculations

Year(s)		Parameter	Value
2006, 2007, and 2008	EPA	75 th percentile	3.6
		80% Confidence Interval	3.4 - 4.1
	Logistic Regression	Maximizing Load	3.7
		80% Confidence Interval	3.3 - 4.1
2009		Median 3.3	
		75 th percentile	4.2

3.0 Additional Revisions

There were other updates to the methodology as well that took place due to revised data inputs from the Chesapeake Bay Program (CBP) for use in calculating both current watershed sediment loads and *all forested watershed sediment loads*. First, updated CBP P5 watershed model land use was acquired. This updated land use was applied to all of the sediment load calculations for the revised reference watersheds and will also be applied in all of the sediment load calculations for all impaired watersheds in post 2008 TMDL analyses. Secondly, revised spatially explicit sediment delivery factors were applied in the calculation of the reference watershed *all forested sediment loads*, which will also be applied in the in the impaired watershed *all forested sediment load* calculations for post 2008 analyses. The current watershed sediment load calculations remain the same, as these calculations have always used spatially explicit – land use specific sediment delivery factors.

REFERENCES

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