

Lower Eastern Shore Water Quality and Habitat Assessment Overall Condition 2010-2012

Healthy rivers and bays support a diverse population of aquatic life as well as recreational uses, such as swimming and fishing. To be healthy, rivers and bays need to have good water and habitat quality. High levels of nutrients and sediment lead to poor water quality. Poor water quality reduces habitat quality, including water clarity (how much light can get to the bottom) and the amount of dissolved oxygen in the water. In turn, habitat quality affects where plants and animals can live. The Maryland Department of Natural Resources (DNR) is responsible for monitoring water and habitat quality in the Chesapeake Bay and rivers, as well as the health of aquatic plants and animals. DNR staff use this information to answer common questions like “How healthy is my river?”, “How does my river compare to other rivers?”, “What needs to be done to make my river healthy?” and “What has already been done to improve water and habitat quality in my river?”

The Lower Eastern Shore basin includes five major rivers and four embayments. Overall, this basin is dominated by agricultural land use and has a low to medium human population density in most areas. Negative impacts from urban land use, percent impervious surface and wastewater treatment plants are much lower than in the Western Shore rivers. Despite the similarities overall among the Lower Eastern Shore rivers, there are differences in water and habitat quality conditions due to localized land use and human impacts.

How healthy are the Lower Eastern Shore Rivers?

How do the Lower Eastern Shore Rivers compare to other Maryland rivers?

Chicamacomico River and Transquaking River Water quality in the Chicamacomico River and Transquaking River is fair. Sediment levels are too high and getting worse in the upstream areas but nitrogen, phosphorus and sediment levels have improved in the lower Transquaking (Table 1). Even though dissolved nitrogen and phosphorus levels are low enough for healthy habitat for underwater grasses, total nitrogen and phosphorus levels are very high. Habitat for underwater grasses is poor because algal densities are too high and water clarity is poor.

The Transquaking River is a ‘Low Urban, High Agriculture’ river. Chicamacomico River is considered part of the Transquaking River system for land use assessments so is not compared separately. Nitrogen, phosphorus and sediment levels and algal densities are among the highest in Maryland rivers (Figure 1). Water clarity is the lowest of all Maryland rivers.

Table 1. Summary of tidal habitat quality and water quality indicators.

Algal densities, water clarity, inorganic phosphorus and sediment either 'Meet' or 'Fail' SAV habitat requirements for 2010-2012. Dissolved nitrogen levels below the level for nitrogen limitation 'Meet' criteria, otherwise 'Fail' criteria. Summer bottom dissolved oxygen levels above 3 mg/l 'Meet' criteria, otherwise 'Fail' criteria. Annual trends for 2003-2012 either 'Increase' or 'Decrease' if significant at $p \leq 0.01$ or 'Maybe Increase' or 'Maybe Decrease' at $0.01 < p < 0.05$; blanks indicate no significant trend. Improving trends are in green, degrading trends are in red. Nitrogen trends are for total nitrogen, phosphorus trends are for total phosphorus, water clarity trends are for Secchi depth. Gray shading indicates areas too shallow for measurement of distinct bottom dissolved oxygen levels.

		Water Quality			Habitat Quality		
River		Nitrogen	Phosphorus	Sediment	Algal Densities	Water Clarity	Summer Bottom Dissolved Oxygen
Transquaking	Chicamacomico	Meet Increase	Meet	Fail Increase	Fail Increase	Fail	
	Transquaking	Meet	Meet	Fail Maybe Inc	Fail Increase	Fail	
		Meet Decrease	Meet Decrease	Fail Decrease	Fail	Fail	
Fishing Bay		Meet Decrease	Meet Maybe Dec	Meet	Meet Decrease	Fail	Meet
Nanticoke	Upstream Upper	Fail Decrease	Meet	Fail Increase	Fail Increase	Fail	Meet Increase
	Downstream Upper	Fail Decrease	Meet	Fail Increase	Fail Increase	Fail	
	Lower	Fail Decrease	Fail	Fail	Fail	Fail	Meet
Wicomico	Upper	Fail Decrease	Meet	Fail Increase	Fail Increase	Fail	
	Middle	Meet Decrease	Meet Decrease	Fail	Meet Maybe Dec	Fail	
	Lower	Meet Decrease	Meet Decrease	Fail	Fail	Fail	Meet
Manokin	Upper	Meet Decrease	Fail	Fail	Meet Increase	Fail	
	Upper	Meet	Fail	Fail	Fail Increase	Fail	
	Lower	Meet Decrease	Meet Decrease	Meet Decrease	Meet Decrease	Fail Increase	Meet Increase
Big Annemessex		Meet Decrease	Meet Decrease	Meet	Meet Maybe Dec	Fail Maybe Inc	Meet
Pocomoke River	Upper	Fail Decrease	Fail Maybe Dec	Meet	Meet Increase	Fail	Meet
	Middle	Fail Decrease	Fail	Fail Increase	Meet Increase	Fail	
	Lower	Meet Maybe Dec	Fail	Fail	Fail	Fail Increase	
Pocomoke Sound		Meet Maybe Dec	Meet	Meet	Meet Maybe Dec	Fail Maybe Inc	Meet
North Tangier Sound		Fail Decrease	Meet	Meet	Meet Maybe Dec	Fail	Meet
South Tangier Sound		Meet Decrease	Meet	Meet	Meet	Meet Increase	Meet Maybe Inc

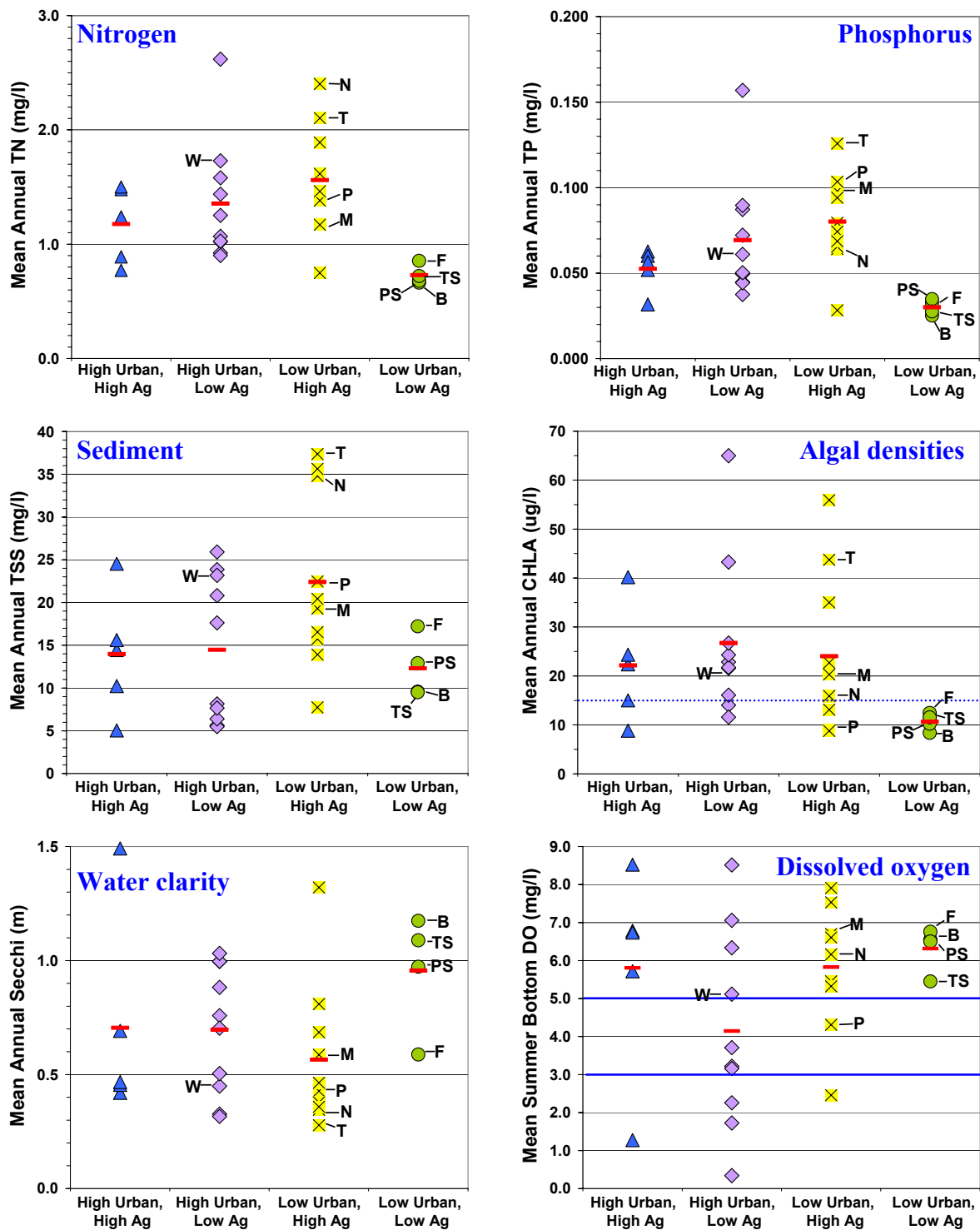


Figure 1. Comparison of the Lower Eastern Shore Rivers to similar rivers.

The mean annual concentration or depth (bottom dissolved oxygen is only summer) for 2010-2012 data. Total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), chlorophyll *a* (CHLA), Secchi depth and summer bottom dissolved oxygen (DO). Red bars indicate the mean of all rivers within a category. Reference lines are included on the CHLA and summer bottom DO graphs. Abbreviations are: T (Transquaking), N (Nanticoke), W (Wicomico), M (Manokin), B (Big Annemessex), P (Pocomoke River), F (Fishing Bay), TS (Tangier Sound) and PS (Pocomoke Sound).

Fishing Bay Water quality in Fishing Bay is good, with moderate nitrogen and sediment levels and low phosphorus levels. Nitrogen levels decreased and phosphorus levels may have decreased. Habitat quality for underwater grasses is fair but water clarity is poor. Algal densities have improved. Underwater grass beds covered approximately 80% of the restoration goal area in 2011, but dropped to 33% in 2012. Summer bottom dissolved oxygen levels are good, but bottom dwelling animals were unhealthy in some areas of Fishing Bay.

Fishing Bay is in the ‘Low Urban, Low Agriculture’ land use category. Nitrogen, phosphorus and sediment levels are high compared to similar systems, and low to moderate compared to other rivers in Maryland. Algal densities are low. Secchi depths are the lowest in this land use category, but are moderate compared to other Lower Eastern Shore rivers.

Nanticoke River Water quality in the Nanticoke River is poor in the upper river due to high nitrogen and sediment levels. Water quality is poor in the middle river because nitrogen, phosphorus and sediment levels are too high. Nitrogen levels improved in both the upper and middle river, but sediment levels have gotten worse in the upper river. Habitat quality for underwater grasses is poor because water clarity is poor and algal densities are too high and increased. No underwater grasses have been found in the Nanticoke. Summer bottom dissolved oxygen levels are good and increased in the upper river, but bottom dwelling animals are unhealthy in many areas of the river.

Nanticoke River is a ‘Low Urban, High Agriculture’ river. Nitrogen and sediment levels are very high in comparison to the other rivers in Maryland and phosphorus levels are moderate. Algal densities are low, but so is water clarity.

Wicomico River Water quality in the Wicomico River is poor in the upper river due to very high nitrogen and high sediment levels. Water quality is fair in the middle and lower river but sediment levels are still too high. Nitrogen levels improved throughout the river and phosphorus levels improved in the middle and lower river. Sediment levels degraded in the upper river. Habitat quality for underwater grasses is poor in the upper and lower river due to high algal densities and poor water clarity. Habitat quality for underwater grasses in the middle river is fair but water clarity is poor. No underwater grasses are found in the Wicomico River. Summer bottom dissolved oxygen levels are good.

Wicomico River is the only ‘High Urban, Low Agriculture’ river in the Lower Eastern Shore Basin. Nitrogen levels are among the highest of all other Maryland rivers. Phosphorus levels and algal densities are moderate within this land use category. Sediment levels are high and water clarity is low compared to similar rivers.

Manokin River Water quality in the Manokin River is poor in the upper river but good in the lower river. Phosphorus levels are extremely high in the creeks, and sediment levels are also too high. Water quality improved due to decreases in nitrogen throughout the river. Phosphorus and sediment levels have improved in the lower river. Habitat quality for underwater grasses is fair to poor because water clarity is low. Algal densities have increased in the upper river but have decreased in the lower river. Water clarity and bottom dissolved oxygen levels have also improved in the lower river. Underwater grass beds covered approximately 12% of the restoration goal in 2011. Summer bottom dissolved oxygen levels are good. Bottom dwelling

animals were healthy in the central portion of the lower river but were very unhealthy in areas closer to shore and in the upper river.

Manokin River is in the ‘Low Urban, High Agriculture’ land use category. Nitrogen levels and algal densities are low compared to similar systems and are moderate compared to all Maryland rivers. Phosphorus levels are high and sediment levels are moderate compared to similar rivers. Water clarity is moderate compared to similar rivers.

Big Annemessex River Water quality in the Big Annemessex River is good and nitrogen and phosphorus levels improved. Habitat quality for underwater grasses is fair because water clarity is low. Habitat quality may also be improving. Underwater grass beds covered about 35% of the restoration goal in 2011 and 2012. Summer bottom dissolved oxygen levels are good.

Big Annemessex is a ‘Low Urban, Low Agriculture’ river. Nitrogen, phosphorus and sediment levels are low or very low compared to other Maryland rivers and water clarity is high.

Pocomoke River Water quality in the Pocomoke River is poor due to high nitrogen, phosphorus and sediment levels, especially in the upper and middle river. Nitrogen levels improved in the entire river and phosphorus levels may have improved in the upper river. Sediment levels have degraded in the middle river. Habitat quality for underwater grasses is fair to poor because water clarity is poor and algal densities are too high in the lower river. Algal densities also increased in the upper and middle river, and water clarity improved in the lower river. Underwater grass beds are almost never seen in the river. Bottom dissolved oxygen levels are fair.

Pocomoke River is in the ‘Low Urban, High Agriculture’ category. Nitrogen levels are moderate but phosphorus and sediment levels are among the highest in Maryland rivers and bays. Algal densities are very low and water clarity is low.

Tangier Sound Water and habitat quality is fair in North Tangier Sound and good in South Tangier Sound. Nitrogen levels improved in both North and South Tangier Sound. Habitat quality for underwater grasses is fair in North Tangier Sound but water clarity is poor. Habitat quality in South Tangier Sound is good for underwater grasses but fair for bottom dwelling animals because dissolved oxygen level are sometimes too low. Underwater grasses covered approximately 25% of the restoration goal in the Maryland portions of Tangier Sound in 2011-2012. Summer bottom dissolved oxygen levels are good and bottom dwelling animals are healthy in Tangier Sound.

Tangier Sound is in the ‘Low Urban, Low Agriculture’ category. Nitrogen, phosphorus and sediment levels in Tangier Sound are better than most of the rivers and bays in Maryland. Algal densities in Tangier Sound are low and water clarity is high in comparison to all of Maryland’s rivers and bays.

Pocomoke Sound Water and habitat quality in Pocomoke Sound is good. Habitat quality for underwater grasses is fair but water clarity is poor. Underwater grasses covered less than 20% of the restoration goal in the Maryland portions of Pocomoke Sound in 2011-2012 but the amount of area covered with grass beds has been increasing in recent years. Summer bottom dissolved oxygen levels are good, and bottom dwelling animals are healthy in the Maryland portion of Pocomoke Sound.

Pocomoke Sound is in the 'Low Urban, Low Agriculture' category. Pocomoke Sound has low nitrogen, phosphorus and sediment levels compared to all rivers and bays in Maryland. Phosphorus levels are the highest within this land use category. Algal densities are low. Water clarity is high compared to all other rivers but moderate within this land use category.

What needs to be done to make the Lower Eastern Shore Rivers healthy?

The biggest water quality issue, shared by almost all the rivers, is poor water clarity. By lowering nutrients and sediment, water clarity should improve which will improve habitat quality for underwater grasses. Reductions in nutrients will also lead to lower algal densities and further improve habitat quality. Dissolved oxygen levels on average were adequate for healthy habitat for bottom dwelling animals, but on shorter time periods very low oxygen levels can and do occur. Reducing algal densities by reducing nutrients will improve dissolved oxygen conditions, especially in shallow water areas.

In most of the rivers, nitrogen levels and/or sediment levels are too high (Nanticoke, Wicomico, Transquaking, Pocomoke River). Reductions in nitrogen, phosphorus and sediment loadings from agricultural lands should be the priority in these rivers, and septic system upgrades to reduce nitrogen should also be considered. Upgrades to wastewater treatment plants will reduce nitrogen loadings in the Wicomico and Nanticoke rivers and these improvements are already in place or planned.

Wicomico River is the most impacted by urban land use. Reducing nutrients and sediment that enter the river with urban runoff are needed. Urban runoff of sediment should also be a priority in the Manokin River. As more areas of the Lower Eastern Shore Basin are developed, alternatives to conventional methods should be used to reduce the amount of impervious surfaces and prevent additional degradation of water quality in the other rivers.

In Tangier Sound and Pocomoke Sound, most of the needed improvements will be due to reducing the nutrient and sediment levels in the rivers. Direct inputs to these water bodies are relatively very small.

What has already been done to improve water and habitat quality in the Lower Eastern Shore Rivers?

A variety of actions have already been taken to lower nitrogen, phosphorus and sediment loadings from agricultural lands. While specific goals have not been set for this basin, improvements are being made. In 2011 there were more than 84,260 acres of cover crops planted in between growing seasons to absorb excess nutrients and prevent sediment erosion. Fencing on 71 acres of farmland was used to keep livestock out of streams and prevent streambank erosion. More than 1,000 containment structures had been built to store animal wastes to allow these nutrients to be applied to the land in the most effective manner at the appropriate time. More than 30,200 acres of stream buffers were also in place, allowing areas next to streams to remain in a natural state with grasses, trees and wetlands.

To reduce nutrient inputs from urban lands, additional actions have been taken. Upgrades to the largest wastewater treatment plants in the basin have been implemented or are under construction. Almost 900 septic system retrofits were completed between 2008-2011, and

stormwater retrofits have reduced nitrogen loadings and prevented 1,080 pounds of nitrogen from entering the rivers since 2003.

Maryland also has a number of programs in place to reduce the impacts of continued development and increasing amounts of impervious surfaces in the Lower Eastern Shore basin. Program Open Space projects have conserved almost 17,350 acres of land for outdoor recreation opportunities. Rural Legacy Program projects have protected more than 14,000 acres, with special focus on areas with important cultural sites and natural resources and to ensure large areas of habitat. Maryland Environmental Trust projects have helped individual land owners protect more than 9,400 acres. Maryland Agricultural Land Preservation Program projects have preserved more than 5,400 acres of agricultural land from development.

For more information

An integrative assessment of the water and habitat quality of the Lower Eastern Shore Rivers is available online at <http://mddnr.chesapeakebay.net/eyesonthebay/tribsums.cfm>.

The full report includes:

- a. Information on land use and human population densities within the basin, including the health of streams and location of Maryland Trust Fund Priority watersheds
- b. Information on land use in 2010, change in land use since 2000 and percent impervious surfaces in watershed
- c. Nutrient and sediment loadings information, including breakdown of nitrogen, phosphorus and sediment load by source (agriculture, urban runoff, point source, etc.).
- d. Loadings information for major wastewater treatment plants including status of upgrades and progress toward loading caps
- e. Water and habitat quality results for tidal waters from long-term monitoring programs
- f. Shallow-water monitoring results including percent failures of dissolved oxygen, chlorophyll and turbidity thresholds and comparison to long-term monitoring stations
- g. Submerged aquatic vegetation coverages
- h. Benthic program results
- i. Appendices with station locations, analysis methods and tabular results

Current water and habitat quality information is also available from Maryland DNR's Eyes on the Bay website www.eyesonthebay.net