MARYLAND DEPARTMENT OF NATURAL RESOURCES

Tidewater Ecosystem Assessment

Lower Western Shore
Water Quality and Habitat Assessment
Overall Condition 2011-2013

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 Western Shore basin can be divided into two regions. The upper region includes the areas that drain to the Magothy, Severn and South rivers. The lower region includes the areas that drain to the Rhode and West Rivers and directly to the mainstem Bay.

Human population density is moderate to high in the upper basin. Urban land use covers more than half of this region, and forest covers about 25% of the area. Septic, urban and point sources are the most important contributors of nitrogen and phosphorus. The largest source of sediment from the region is urban runoff.

Human population density is moderate in the lower basin. Land use is almost 50% forest and urban land use covers about 30% of the area. Point sources and agriculture are the most important contributors of nitrogen and phosphorus. Agriculture is the largest source of sediment from the region.

How healthy are the Lower Western Shore Rivers?

Magothy River Water quality in the Magothy River is good. Habitat quality for underwater grasses is poor due to high algal densities and low water clarity (Table 1). Very few underwater grass beds are found in the Magothy River. Dissolved oxygen levels are very low in the summer so habitat quality for bottom dwelling animals is poor. Bottom dwelling animals are not healthy in many areas of the river.

Severn River Water quality in the Severn River is fair though nitrogen levels are high. Habitat quality for underwater grasses is poor due to high algal densities and low water clarity. The Severn River has more underwater grasses than the other rivers in the basin; underwater grass beds covered about 40% of the area needed to meet the restoration goal during this period.

Dissolved oxygen levels are very low in the summer so habitat quality for bottom dwelling animals is poor. Bottom-dwelling animal populations are not healthy in most areas of the river.

South River Water quality in the South River is good. Habitat quality for underwater grasses is poor. Very few underwater grass beds are found in the South River. Dissolved oxygen levels are very low in the summer so habitat quality for bottom dwelling animals is poor. Bottom dwelling animals are not healthy in most areas of the river.

Rhode River Water quality in the Rhode River is good. Habitat quality for underwater grasses is poor due to high algal densities and low water clarity. Water clarity has also gotten worse. No underwater grass beds have been found in the Rhode River since 1978. Dissolved oxygen levels and habitat quality are fair to good for bottom dwelling animals.

West River Water quality in the West River is good. Habitat quality for underwater grasses is poor due to high algal densities and low water clarity. Water clarity has also gotten worse. No underwater grass beds have been found in the West River since 2004. Summer bottom dissolved oxygen levels are fair to good and bottom dwelling animals are healthy in most areas.

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 2011-2013. Dissolved nitrogen levels below the level for nitrogen limitation 'Meet' criteria, otherwise 'Fail' criteria. Summer bottom dissolved oxygen levels either 'Meet' or 'Fail' EPA open-water 30 day dissolved oxygen criteria. Annual trends for 1999-2013 either 'Increase' or 'Decrease' if significant at $p \leq 0.01$; 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.

	Water Quality			Habitat Quality		
River	Nitrogen	Phosphorus	Sediments	Algal Densities	Water Clarity	Summer Bottom DO
Magothy	Meet	Meet	Meet	Fail	Fail	Fail
Severn	Fail	Meet	Meet	Fail	Fail	Fail
South	Meet	Meet	Meet	Fail	Fail	Fail
Rhode	Meet	Meet	Meet	Fail	Fail Decreasing	Meet
West	Meet	Meet	Meet	Fail	Fail Decreasing	Meet

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

The Magothy, Severn and South Rivers are in the 'High Urban, Low Agriculture' land use category. Nitrogen, phosphorus and sediment levels are similar in all three rivers and low compared with other high urban systems (Figure 1). Algal density is also similar in all three rivers and moderate compared to other rivers. Water clarity is better than in other high urban

rivers, but summer bottom dissolved oxygen levels are low and summer bottom dissolved oxygen levels in the South River are among the worst of all Maryland rivers.

Rhode River is included as part of the West River watershed for land use assessments. The West/Rhode system is in the 'High Urban, High Agriculture' land use category. Nitrogen levels are low compared to other high urban rivers and phosphorus, sediments and algal levels are moderate. Water clarity is lower in the West/Rhode rivers than in the other Lower Western Shore rivers, and summer bottom dissolved oxygen levels are much higher.

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

Even though nutrient and sediment levels are meeting underwater grass habitat requirements in all of the rivers, habitat is degraded by poor water clarity and high algal densities. Low dissolved oxygen levels in the Magothy, Severn and South rivers are further degrading habitat in those rivers. The disconnect between water quality and habitat quality is likely the result of seasonal differences in dissolved nitrogen levels and algal densities. Algal populations use dissolved nitrogen to fuel growth. Dissolved nitrogen levels peak in the winter and early spring along with the river flow for the year (in most years). The higher the dissolved nitrogen levels in the spring, the greater the algal population can increase. As the result of this algal growth, dissolved nitrogen is used up and summer dissolved nitrogen levels in the water are low. So, while dissolved nitrogen levels are low in the summer, the high algal densities indicate that nitrogen levels are still too high in the rest of the year, especially in the winter and spring. Actions that reduce nitrogen loadings need to be a priority. These nitrogen reduction methods need to address loads from septic systems in the northern basin. Reducing algal densities by reducing nitrogen will also increase dissolved oxygen conditions and improve habitat for bottom dwelling animals.

Reductions in sediment loads will contribute to improved water clarity. Sediment load reduction efforts should target urban runoff sources in the northern basin and agricultural sources in the southern basin. As more land is converted from agriculture to urban uses in the southern basin, management actions should address urban runoff in the entire basin. It is most likely that urban areas will continue to increase, so methods to reduce impervious surface coverage become even more necessary. Alternatives to conventional development methods should be used to reduce the amount of impervious surfaces and prevent degradation of water quality.

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

A variety of actions have been taken to lower nitrogen, phosphorus and sediment loadings from urban lands. While specific goals have not been set for this basin, improvements are being made. Upgrades to the major wastewater treatment plants in this basin are under construction and will be completed by 2016. Stormwater retrofits have reduced nitrogen loadings and prevented more than 10,200 pounds of nitrogen from entering the rivers since 2003, and almost 720 septic system retrofits were completed between 2008 and 2013.

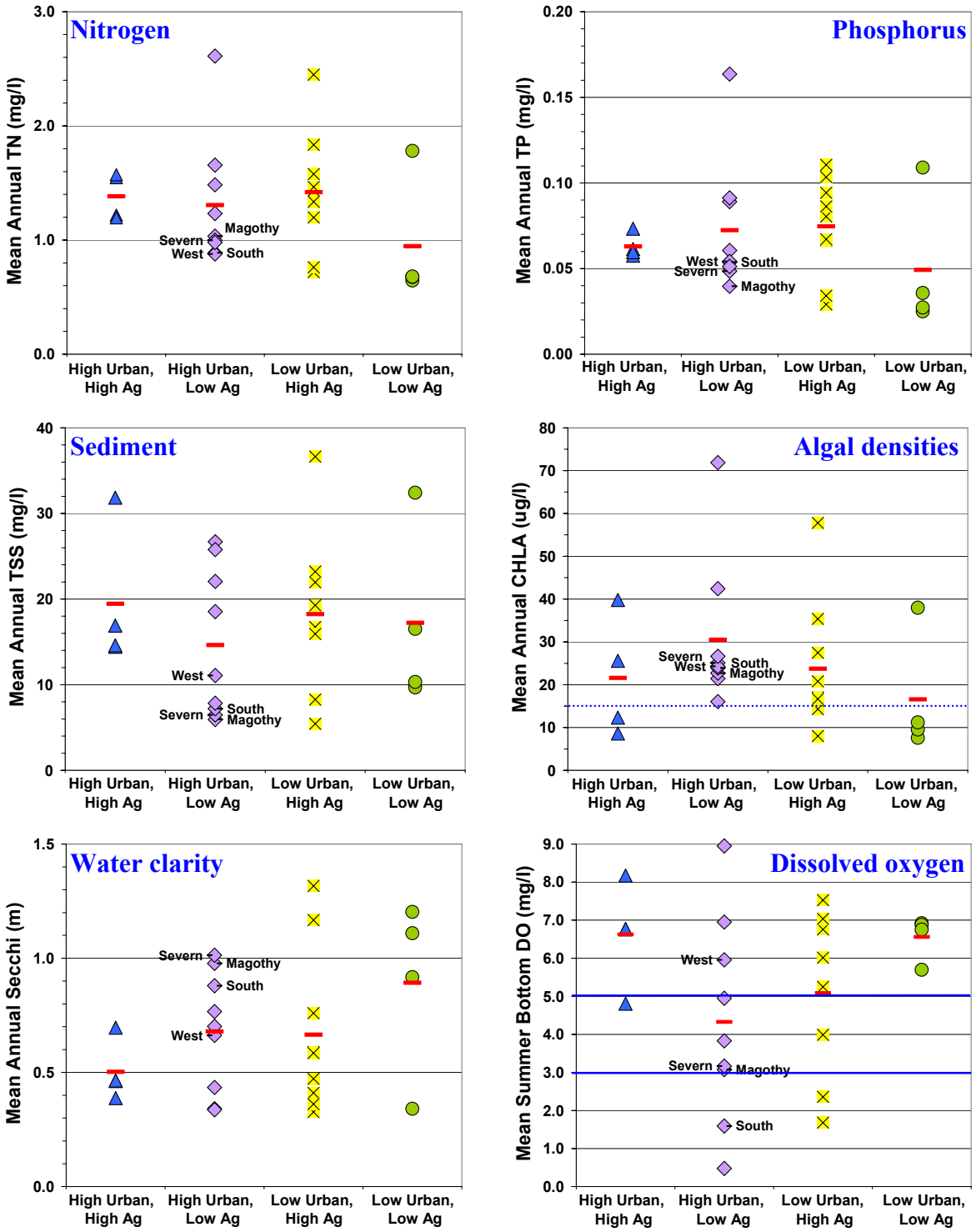

Figure 1. Comparison of the Lower Western Shore Rivers to similar rivers.
The mean annual concentration or depth (bottom dissolved oxygen is only summer) for 2011-2013 data. Total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), chlorophyll *a* (CHLA), Secchi depth and summer bottom 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. Rhode River is included as part of the West River watershed for land use assessments, so it is not shown separately.

To reduce nutrient inputs from agricultural lands, additional management actions have been taken. In 2013 there were more than 1,640 acres of cover crops planted in between growing seasons to absorb excess nutrients and prevent sediment erosion. Fencing on over 810 acres of farmland was used to keep livestock out of streams and prevent streambank erosion. More than 385 acres of stream buffers were also in place, allowing areas next to streams to remain in a natural state with grasses, trees and wetlands.

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 Western Shore basin. Rural Legacy Program projects have protected almost 970 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 2,150 acres and Agricultural Land Preservation Program projects have preserved almost 200 acres of agricultural land from development.

For more information
An integrative assessment of the water and habitat quality of the Lower Western Shore Rivers for 1985-2010 is available online at **http://mddnr.chesapeakebay.net/eyesonthebay/tribsums.cfm**.

The full report includes:

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

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

This report was funded in part through a grant from the Environmental Protection Agency Chesapeake Bay Program Office.

Chesapeake Bay Program
A Watershed Partnership