

Upper 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 Upper Western Shore includes the Bush, Gunpowder and Middle rivers. The central region of the basin drains to the Bush River. The lower region of the basin drains to the Gunpowder and Middle Rivers. The upper region of the basin drains to the Susquehanna River, but due to the overwhelming influence of the portions of the river’s watershed that are in Pennsylvania and New York, the Susquehanna River is not included in this report.

Human population density is moderate in the upper region, moderate to high in the central region and lower region, and very high in the outskirts of Baltimore City. In the upper and lower region, land use is roughly one-third urban, one-third forest and one-third agricultural uses. In the central region, land use is approximately 50% urban.

In the Bush River watershed, point sources are the most important contributor of nitrogen and phosphorus; the largest sources of sediment are urban runoff and agricultural land uses. In the Gunpowder watershed, agriculture is the largest source of nitrogen and sediment loads and urban runoff is the largest source of phosphorus loads. In the Middle River watershed, point sources are the largest source of nitrogen and phosphorus loads, though there are no major wastewater treatment plants that discharge to the river. Urban runoff is the largest source of sediment loads to Middle River.

How healthy are the Upper Western Shore Rivers?

Bush River Water quality in the tidal Bush river is fair due to high sediment levels and is worsening due to increasing phosphorus levels. Habitat quality for underwater grasses is poor due to poor water clarity and high algal densities; algal densities also increased. Underwater grasses covered almost 80% of the restoration goal area during this period. Summer bottom dissolved oxygen levels are good. Bottom dwelling animals are healthy in most areas sampled during this period.

Gunpowder River Nitrogen and sediment loadings from the watershed to the non-tidal Gunpowder River have increased. Water quality in the non-tidal river is fair due to nitrogen concentrations that are too high. Nitrogen levels have increased but phosphorus and sediment levels decreased.

Water quality in the tidal Gunpowder River is fair due to sediment levels that are too high and is worsening due to increasing nitrogen levels. Habitat quality for underwater grasses is poor due to high algal density and poor water clarity, and both are getting worse. Underwater grasses covered 57% of the restoration goal area during this period. Summer bottom dissolved oxygen levels are good and bottom dwelling animals are healthy in most areas of the river sampled during this period.

Middle River Water quality in the Middle River is good. Habitat quality for underwater grasses is poor due to high algal densities and poor water clarity, and water clarity has decreased. Underwater grasses covered 40% of the restoration goal area during this period. Summer bottom dissolved oxygen levels are good. Bottom dwelling animals are healthy in some areas sampled during this period but are not healthy in other 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.

River	Water Quality			Habitat Quality		
	Nitrogen	Phosphorus	Sediments	Algal Densities	Water Clarity	Summer Bottom DO
Bush	Meet	Meet Increasing	Fail	Fail Increasing	Fail	Meet
Gunpowder	Meet Increasing	Meet	Fail	Fail Increasing	Fail Decreasing	Meet
Middle	Meet	Meet	Meet	Fail	Fail Decreasing	Meet

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

The Bush River is in the ‘High Urban, Low Agriculture’ land use category. Nitrogen, phosphorus and sediment levels are high compared with other high urban systems, and algal densities are among the highest of all Maryland rivers and bays (Figure 1). Water clarity is among the worst of all rivers.

The Gunpowder River is in the ‘High Urban, High Agriculture’ land use category. Middle River is included as part of the Gunpowder River watershed for land use assessments, so it is not separately comparable to the other Maryland rivers and bays. Compared to other similar systems, the Gunpowder has low nitrogen, phosphorus and sediment levels and moderate algal densities. However, water clarity is among the worst of the high urban systems.

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

The most important problems that should be addressed are phosphorus and sediment loadings, high sediment levels in the tidal waters, and the large amounts of impervious surfaces in the watershed. Efforts to lower nutrient and sediment loadings from urban and agricultural areas are needed, especially to reduce turbidity in the shallow water areas. Reducing nitrogen loadings from septic systems should also be a priority. With lower nutrients and sediment levels, water clarity should improve which will improve habitat quality for underwater grasses. Reductions in nutrients will also lead to lower algal densities and reduce the frequency and duration of harmful algal blooms. While habitat quality is already good for bottom dwelling animals, reductions in nutrients are expected to lead to more diverse and stable populations.

What has already been done to improve water and habitat quality in the Upper 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 three of the six largest wastewater treatment plant that discharge to the basin have been completed, two others will be completed by the end of 2014, and the final facility will be upgraded by the end of 2016. The completed upgrades have already reduced the nitrogen loadings by more than half. Stormwater retrofits have reduced nitrogen loadings and prevented more than 58,500 pounds of nitrogen from entering the rivers since 2003, and almost 250 septic system retrofits were completed between 2008 and 2013.

To address nutrient inputs from agricultural lands, additional management actions have been taken. In 2013 there were almost 22,500 acres of cover crops planted in between growing seasons to absorb excess nutrients and prevent sediment erosion. Fencing on over 15,970 acres of farmland was used to keep livestock out of streams and prevent streambank erosion. More than 510 containment structures had been built to store animal wastes and allow these nutrients to be applied to the land in the most effective manner at the appropriate time. More than 3,900 acres of stream buffers were also in place, allowing areas next to streams to remain in a natural state with grasses, trees and wetlands.

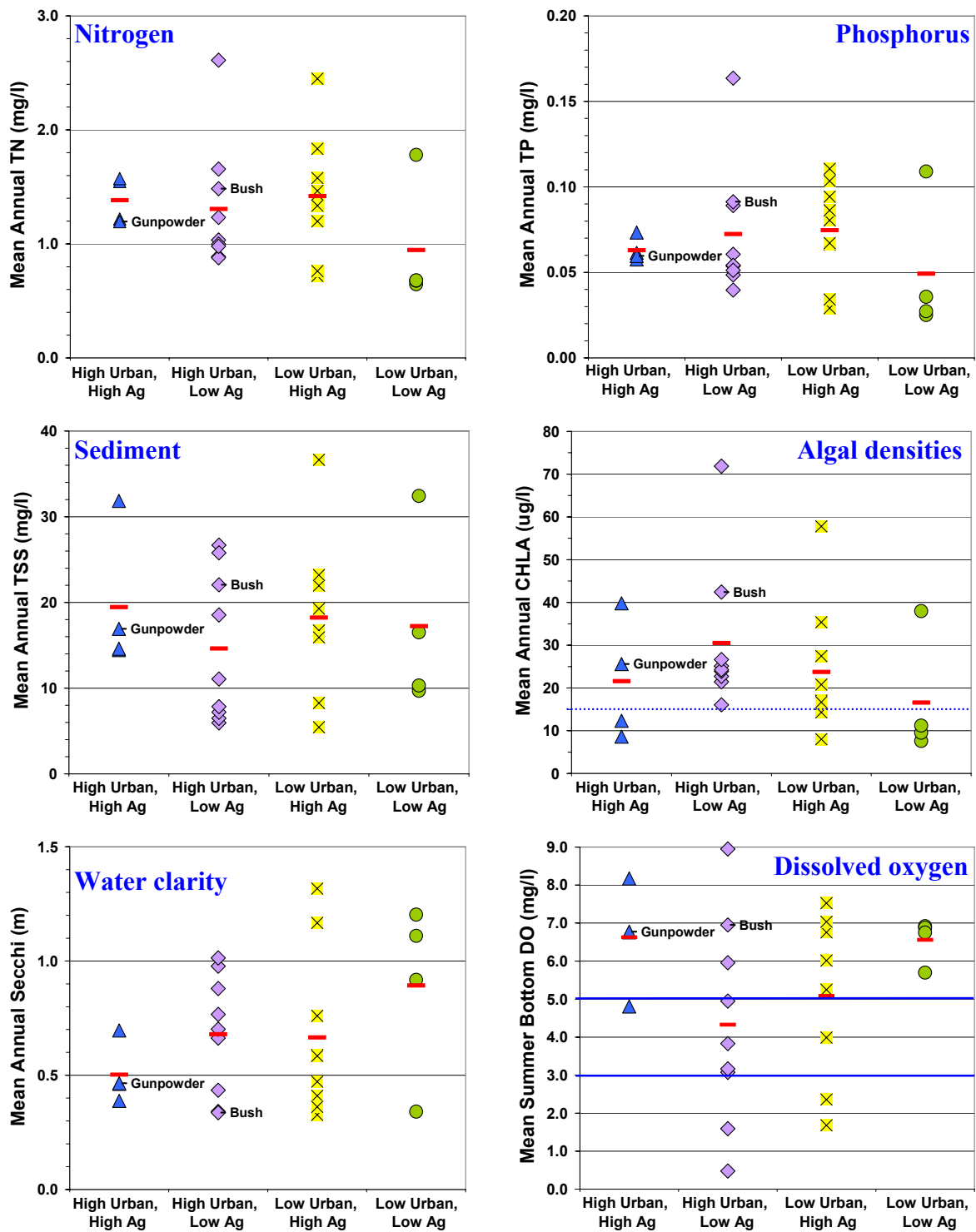


Figure 1. Comparison of the Bush River and Gunpowder River to similar rivers.

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 systems within a category. Reference lines are included on the CHLA and summer bottom DO graphs. Middle River is included as part of the Gunpowder River watershed for land use assessments, so it is not separately compared to the other Maryland rivers and bays.

Maryland also has a number of programs in place to reduce the impacts of continued development and increasing amounts of impervious surfaces in the Upper Western Shore basin. Program Open Space projects have conserved nearly 1,380 acres of land for outdoor recreation opportunities. Rural Legacy Program projects have protected more than 9,860 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 5,680 acres. Maryland Agricultural Land Preservation Program projects have preserved more than 3,860 acres of agricultural land from development.

For more information

An integrative assessment of the water and habitat quality of the Upper 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 and tabular results

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

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