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Background

This County, including its Chesapeake Bay Islands, is 212,480 acres. Most of the County is less than 40 feet above sea level, with about 90% being less than 20 feet above sea level. Only 10% of the County can be farmed without using artificial drainage (USDA, 1966).

Land use in Somerset County is divided between agriculture (27%), forest (40%), and wetlands (27%) (based on MDP 2002 land use GIS data). Wetlands are concentrated in the western portion of the County. Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere

in this document, are based on GIS data from DNR. There is also a smaller amount of developed land, including a fair amount around Princess Anne.

Sea level rise is a serious issue in this County. Studies are being conducted to predict land change based on sea level rise. These maps predict that mean high water will cover large areas of the County. Wetlands are currently being lost due to sea level rise and subsidence. However, for the same reasons, uplands are also being converted to wetlands. Salt tolerant species are encroaching into people's yards (Titus and Richman, 2000). This also leads to septic system failure. The climax communities for these new wetlands will likely be brackish high and low marsh. It is likely that land converted to wetlands will be lost to sea level rise in the long term. Therefore, designs for wetland restoration should take this into account. One idea is to use dredged material to create barrier islands just off the shoreline. These could buffer the shoreline against storm surges and wind-driven waves, and provide some protection for wetland restoration behind them (Cole, 2006, pers. comm.).

Somerset County drains into three different State-designated 6-digit watersheds: Pocomoke River (021302), Nanticoke River (021303), and Chesapeake Bay Proper (021399). The 8-digit watersheds within the Somerset portion of the Pocomoke River watershed include: Pocomoke Sound (02130201), Lower Pocomoke River (02130202), Dividing Creek (02130204), Tangier Sound (02130206), Big Annemessex River (02130207), and Manokin River (02130208). The 8-digit watersheds within the Somerset portion of the Nanticoke River watershed include: Lower Wicomico River (02130301), Monie Bay (02130302), and Wicomico Creek (02130303). The 8-digit watersheds within the Somerset portion of the Chesapeake Bay (proper) watershed include Lower Chesapeake Bay (02139998).

Streams

The following information is based on the Maryland Tributary Strategies 2004 document entitled *Maryland's Lower Eastern Shore*. Maryland's Lower Eastern Shore basin includes areas in Wicomico, Caroline, Somerset, Worcester, and Dorchester Counties and the waterways Pocomoke, Wicomico, Nanticoke and Big Annemessex Rivers, Fishing Bay, Pocomoke and Tangier Sounds. Land cover is 61% forest/wetlands and 32% agriculture. About 60% of the houses are on septic. Point sources are not a major source of pollution. In 2002, sources of nitrogen, phosphorus, and sediments were from agriculture (60%, 58%, 70% respectively). Based on water quality sampling, nitrogen was good or fair in the southern portion and poor in Wicomico and Nanticoke Rivers. Phosphorus was good or fair throughout. Total suspended solids (TSS) was poor in the majority of the area, with only three sampling having fair or good TSS (South Tangier Sound, Big Annemessex River, and Pocomoke River). All areas were below the SAV restoration goal. Benthic communities were generally good, with the best communities located in Nanticoke and Wicomico Rivers. Degraded communities were likely impacted by high sedimentation. This document describes the success of implementing BMPs like this:

Implementation of animal waste management plans, nutrient management plans,
conservation tillage, treatment of highly erodible land, forest conservation and buffers, marine pumpouts, and structural shore erosion control and erosion and sediment control are all making good progress toward Tributary Strategy goals. For other issues, such as stormwater and urban nutrient management, cover crops, tree plantings and nonstructural shore erosion control, progress has been slower.

Wetlands

Wetland classification

According to Tiner and Burke (1995), in 1981-1982 there were 81,563 acres of wetlands (13.6% of the State's total). The wetland types were Estuarine (62,408 acres) and Palustrine (19,155 acres). Comparisons of this 1981-1982 wetland acreage with historic wetland acreage (based on hydric soils) represents a 51%, or 85,893 acre, loss (MDE, 2002). This County has the second highest amount of tidal wetlands in the State and is very important for wildlife (Sipple, 1999).

A 1994 report from the U.S. Fish and Wildlife Service (Tiner and Foulis) estimated wetland trends in part of Somerset and surrounding Counties for the period from 1982 to 1988-89. The study area was the U.S. Geological Survey quadrangles for Princess Anne (Somerset), Salisbury (Somerset and Wicomico Counties) Wango (Wicomico and Worcester Counties) Delamr (Wicomico) and Pittsville (Wicomico County). There were over 187 acres of vegetated wetlands, primarily palustrine forested wetlands, that were converted to upland. Conversion to agricultural land and ditching were the primary causes. There were over 2700 acres of wetlands were converted to another wetland type, with most changes due to silvicultural practices to establish plantations for Loblolly pine (*Pinus taeda)*. Other changes resulted from forested wetland timber harvest, with the succeeding wetland types being scrub-shrub or emergent wetlands. The water regime was also altered in some wetlands.

The following wetland plant community descriptions are based on Tiner and Burke (1995).

- Estuarine wetlands can be salt or brackish tidal wetlands. Vegetation is largely dependent upon salinity and hydrology, with plant diversity increasing with decreased salinity and decreased flooding. They can be classified into five groups:
    - Estuarine intertidal flats are mud or sand shores that are exposed twice a day (at low tide) or less. These areas have sparse macrophytic vegetation.
    - Estuarine emergent wetlands have vegetation composition that is strongly influenced by salinity level and duration/frequency of inundation.
        - Brackish marshes are the most common type of Maryland Estuarine wetland, found along the Chesapeake Bay and tidal rivers. Low brackish marsh is often dominated by smooth cordgrass-tall form and water hemp while the high brackish marsh

is often dominated by salt hay grass, salt grass, black needlerush, smooth cordgrass-short form, Olney three-square, switchgrass, common three-square, big cordgrass, common reed, salt marsh bulrush, seaside goldenrod, rose mallow, and narrow-leaved cattail.

- Oligohaline marshes are only slightly saline and are located in the upper tidal rivers. Low oligohaline marshes are often dominated by arrow arum, pickerelweed, spatterdock, wild rice, soft-stemmed bulrush, narrow-leaved cattail, water hemp, and common three-square while high oligohaline marshes are often dominated by big cordgrass, common reed, narrow-leaved cattail, wild rice, broad-leaved cattail, and sweet flag.

- Estuarine scrub-shrub swamps are often dominated by high-tide bush and groundsel bush.
- Estuarine forested swamps are often dominated by loblolly pine. Due to sea level rise bringing in more salinity, some of these systems are being converted into salt marshes. This situation is common in Somerset.
- Estuarine Aquatic beds generally contain submerged aquatic vegetation, including eelgrass and widgeongrass in high salinity areas and widgeongrass and other species in lower salinity areas.

- Palustrine wetlands can be classified into four major groups depending on the dominant vegetation type: forested, scrub-shrub, emergent, and aquatic. These wetlands were described for the Maryland Coastal Plain Province.
  - Palustrine forested wetlands are the dominant palustrine wetland type on the Coastal Plain and are located in floodplains, depressions, and drainage divides. They can be classified into four main groups:
    - Tidally flooded wetlands are freshwater wetlands that are tidally influenced. Common tree species may include red maple, green ash, black willow and black gum.
    - Semipermanently flooded wetlands are nontidal wetlands that are flooded for much of the growing season. These are uncommon in Maryland. Some examples, dominated by bald cypress, are along Battle Creek and the Pocomoke River. Higher elevations may be dominated by red maple, black gum, sweet bay, swamp black gum, fringe tree, ironwood, and swamp cottonwood.
    - Seasonally flooded wetlands are nontidal wetlands that are flooded for generally longer than two weeks during the growing season. Some of the more common tree dominants include red maple, sweet gum, pin oak, willow oak, loblolly pine, or swamp chestnut oak. There is often a thick shrub understory.
    - Temporarily flooded wetlands are nontidal wetlands that are flooded the least of the four types, about a week. Seasonally saturated wetlands, wetlands having a high water table during the cooler months, are also included in this category. Some of these areas are managed for loblolly pine harvesting. Other tree dominants include red maple, sweet gum, black gum, willow oak,

water oak, basket oak, swamp white oak, southern red oak, sycamore, black willow, American holly, sweet bay.

- Scrub-Shrub wetlands are less common than forested wetlands on the Coastal Plain. They are often dominated by buttonbush (in the wetter systems), silky dogwood, arrowwood, alder and tree saplings.
- Emergent wetlands are very diverse in the Coastal Plain region due to the occurrence of both tidal and nontidal wetlands. They can be categorized into several different types:
  - Tidal fresh marshes occur along the large coastal waterways, between the brackish marshes and tidal freshwater swamps. It is speculated that in addition to tidal flooding, temporary periods of salt water in these areas may discourage woody succession. These freshwater wetlands are often more diverse than wetlands with higher salinity levels. Vegetative dominance changes seasonally. There is often a distinct vegetative zonation pattern based on elevation. Some common dominance types according to McCormick and Somes (1982) are arrowheads, big cordgrass, bulrushes, bur-marigold, cattails, common reed, giant ragweed, golden club, pickerelweed/arrow arum, purple loosestrife, reed canary grass, rose mallow, and smartweed/rice cutgrass
  - Interdunal wet swales have a very high water table, allowing hydrophytic plants to grow adjacent to dunes having xeric plant species. These sites are often dominated by common three-square, salt hay grass, and rabbit-foot grass.
  - Semipermanently flooded marshes are often dominated by cattail, spatterdock, arrow arum, water willow, and bur-reeds.
  - Seasonally flooded marshes include isolated depressional wetlands called “potholes” or “Delmarva Bays” (mostly in Caroline, Kent, and Queen Anne’s)
  - Temporarily flooded wet meadows include areas recently timber harvested that will soon revert back to woody vegetation.
- Aquatic beds include small ponds with vegetation on the bottom and/or surface. These are the wettest of the Palustrine types.

- Riverine wetlands are found within the channel and include nonpersistent vegetation.
- Lacustrine wetlands are associated with deepwater habitat (e.g. freshwater lakes, deep ponds, and reservoirs). They can be classified into lacustrine aquatic beds (wetlands are located in the shallow water) and lacustrine emergent wetlands (wetlands are located along the shoreline).

The document *Wetlands of Maryland* provides numerous examples of various wetland communities found within each County and complete plant lists for certain wetland types.

Tidal wetland acreage was also estimated in *The Coastal Wetlands of Maryland* (Table 1). Somerset County had 50,816 acres of vegetated tidally-influenced wetlands (excluding SAV). The majority of the vegetated wetlands were brackish. Due to the higher stress associated with higher salinity levels, brackish marsh often has lower

species richness and species diversity than fresh tidal marsh. Brackish marsh may also have quite distinct plant zonation patterns. Based on 1976 data, wildlife managers, private landowners, and arsons intentionally set fires to large expanses of brackish marsh during November/December. These targeted areas include Deal Island, Dames Quarter, Fairmount Neck, Jersey Island, and Johnson Creek.

Table 1. Tidal wetland acreage within Somerset County based on vegetation type (McCormick and Somes, 1982).

Major Vegetation Type	Vegetation Type	Acreage
Shrub Swamp *(Fresh)*	Swamp rose	0
	Smooth alder/Black willow	1
	Red maple/Ash	67
Swamp forest *(fresh except pine, which is often brackish)*	Bald cypress	559
	Red maple/Ash	519
	Loblolly pine	181
Fresh marsh	Smartweed/Rice cutgrass	63
	Spatterdock	0
	Pickerelweed/Arrow arum	61
	Sweetflag	11
	Cattail	132
	Rosemallow	26
	Wildrice	0
	Bulrush	0
	Big cordgrass	190
	Common reed	1
Brackish High Marsh	Meadow cordgrass/Spikegrass	13,236
	Marshelder/Groundselbush	3,057
	Needlerush	22,543
	Cattail	197
	Rosemallow	4
	Switchgrass	253
	Threesquare	1,656
	Big cordgrass	1,093
	Common reed	38
Brackish Low Marsh	Smooth cordgrass	6,901
Saline High Marsh	Meadow cordgrass/Spikegrass	0
	Marshelder/Groundselbush	0
	Needlerush	0
Saline Low Marsh	Smooth cordgrass, tall growth form	0
	Smooth cordgrass, short growth form	0
Submerged Aquatic Vegetation	Submerged aquatic plants	15,208

The 1984 document entitled *Uncommon Wetlands in the Coastal Plain of Maryland* lists the 14,435-acre Pocomoke Swamp as being an uncommon wetland type. This wetland

contains cypress swamp, shrub swamp, and marsh and is important due to its large size, unusual vegetation type, rare plants, and high overall diversity.

Sipple (1999) identifies at least three wetlands he classifies as Carolina Bays in Somerset (in contrast to Delmarva Bays). These are near the towns of Manokin (bisected by Rte. 361), Rumbley, and Parsonville (all much larger in size than the Delmarva Bays).

Brackish marshes are becoming wetter due to sea level rise, subsidence, erosion, and herbivore grazing. One example of vegetative community change within Somerset and Dorchester Counties includes Loblolly Pine islands that are being replaced by more water-tolerant marsh vegetation (Sipple, 1999).

Wetland Functions

Stormwater and Flood Control

Wetlands are often credited with providing natural stormwater and flood control benefits. Inland wetlands adjacent to rivers, streams and creeks hold excess discharge and runoff during periods of increased precipitation such as tropical storms and hurricanes and during periods of rapid snow-melt in mountainous regions. Coastal wetlands also hold excess discharge from inland drainage networks as well as tidal waters during storms.

Several factors influence the effectiveness of a wetland in reducing adverse effects of stormwater and floods. Factors include the characteristics of the wetland, local land conditions, and landscape features in the surrounding larger watershed, as well as the type of storm itself. The physical structure of many wetlands, with dense vegetation, fallen trees, topography (hummocks, depressions), and complexity of stream channel systems serve as resistance features to slow flow of surface water from floods and surface runoff, the height of peak floods, and delay the timing of the flood crest. Wetlands are typically in topographically low position, which provides a natural basin for water storage. The depth of the basin and soil characteristics affect the wetland's storage capacity at surface and subsurface levels. Water is released more slowly from the wetlands, thereby reducing both erosion and damage to property and structures farther downstream. In the surrounding areas, the ability of the land to also reduce runoff may aid the wetland in its flow retention/reduction function. At the landscape level, the position of the wetland in the watershed and the ratio of size of the wetland to the size of the watershed also affect the function. Wetlands higher in the landscape and of large in size in relation to the watershed are most effective. While wetlands retain surface flows that enter the wetlands at a gradual rate, they are considered to be more effective at reducing damages from short duration storms.

Also, some water will be removed from the wetland through ground water recharge, soil retention and evapotranspiration.

The associated value of this function can be summarized as follows:

c. A decrease in the volume and velocity of flowing water.
   Value: Helps prevent stream channel and shoreline erosion, and habitat destruction.
d. Deposition and retention of fine sediment.
   Value: Helps maintain water quality and aquatic ecosystems.
e. Water storage by extending the period of time during which flood waters are released back into the drainage system.
   Value: Helps prevent the flooding of homes, property, agricultural lands, and structures such as dams, bridges, and roads.

While depressional wetlands often exhibit little elevation differences from surrounding uplands, water still moves slowly due to the generally flat topography and may thus provide retention times sufficient to transform or uptake nutrients.
The ditching and channelization of streams has reduced the ability of some floodplain wetlands to perform a flood attenuation function.

Groundwater Recharge and Discharge

Functions
Wetlands facilitate the flow of water between the ground water system and surface water system. Wetlands periodically perform different functions, depending on the gradient of the groundwater table and the topography of the land surface. The relationship of the groundwater table and the land surface dictates which function - groundwater recharge or discharge - a wetland performs.

Nearly all of Maryland's wetlands are ground water discharge areas, at least for some portion of the year (Fugro East, Inc., 1995). Variations in the depth of the ground water table, resulting from seasonal changes in climate, dictate which of these functions - discharge or recharge - a wetland will perform at a given time.

Values
Ground water discharge helps maintain a wetland's water balance and water chemistry. This wetland function is also critical to the formation of hydric soils and the maintenance of ecosystem habitats in different types of wetlands.
Ground water recharge is the primary mechanism for aquifer replenishment which ensures future sources of groundwater for commercial and residential use.

Modification of Water Quality

Water Quality Improvement
Wetlands are valued for their ability to maintain or improve quality of adjacent surface waters. This ability is primarily accomplished by the following processes:

- Nutrient removal, transformation, and retention
- Retention of toxic materials
- Storage of the sediment transported by runoff or floods.

Hydrophytic vegetation (adapted to live in water) and microbial activity in soils help remove toxic substances and excess nutrients from surface water. Dissolved solids and

other constituents may be removed or degraded, such that they become inactive, or incorporated into biomass. This occurs through adsorption and absorption by soil particles, uptake by vegetation and loss to the atmosphere through decomposition and exchange between atmosphere and water.

Nutrient Cycling: Addition, Removal and Transformation

Nutrients are carried into wetlands by hydrologic pathways of precipitation, river flooding, tides, and surface and ground water inflows. Outflows of nutrients are controlled primarily by outflow pathways of waters. The inflow and outflow of water and nutrients are important processes that effect wetland productivity.

Wetland biological and chemical processes remove suspended and dissolved solids and nutrients from surface and ground water and convert them into other forms, such as plant or animal biomass or gases. Debris and suspended solids (fine sediment or organic matter) may be removed by physical processes, such as filtering and sedimentation.

Soil characteristics, landscape position, and hydrology all contribute to the relative ability of a wetland to perform nutrient removal and transformation. Sufficient organic matter must be present for microorganisms in the soil to consume or transform the nutrients. Wetlands are often depressions in the landscape that hold water, transported sediment, and attached or dissolved nutrients for a longer period of time than a sloping area or areas with relatively higher elevations. A longer retention time allows for chemical interactions and plant uptake to occur.

Nitrogen undergoes some chemical transformations and may be taken up in soluble form, absorbed by plants through their roots, or consumed by anaerobic microorganisms that convert the nitrogen to organic matter (Mitsch and Gosselink, 2000). Anaerobic microbes may also convert the nitrogen from a nitrate form to nitrogen gas. Phosphorus is often bound to clay particles, and these fine sediments are transported into wetlands by riparian flooding and tidal action. Phosphorus may be stored in a wetland attached to the clay particles, however, phosphorus becomes available for plant uptake in its soluble form after flooding, saturation and anaerobic conditions typical of a wetland occur. Nutrient processes vary seasonally. Cooler temperatures slow microbial activity and plant uptake while higher flows of water transport more materials out of non-isolated wetland systems. The transported organic material is critical for downstream food chain support.

Tidal wetlands are highly effective sinks and/or transformers of nutrients, as nutrients are taken up and stored by plants or released as nitrogen gas into the atmosphere. However, the uptake and transformation occurs on a seasonal basis during the growing season. At the end of the growing season, as plants die and decompose, nutrients are released back into the aquatic system.

Wetlands are most effective at nutrient transformation and uptake when there are seasonal fluctuations in water levels (Tiner and Burke, 1995). Wetlands that are temporarily flooded (saturated or inundated for brief periods early in the growing season) and those that are permanently inundated would generally be less effective than

seasonally wet areas (saturated or inundated for longer periods during the early-mid growing season but are drier by the end of the growing season).

The loss of marshes from erosion due to nutria herbivory and sea level rise may increase water quality problems as loose sediments and attached nutrients are released into the water column.

Toxics Retention

Retention of heavy metals has been reported most often in studies of tidal wetlands, though most wetlands are believed to serve as sinks for heavy metals. Accumulation is primarily in soils, with plants playing a more limited role (Mitsch and Gosselink, 2000). Plants such as cattails, bulrushes, and *Phragmites* are among the more effective and commonly used plants for uptake of toxic materials such as metals. As is the case for nutrient transformation and sediment retention, soil characteristics, landscape position, vegetation, and hydrology all contribute the relative ability of a wetland to retain toxic materials. The longer the duration that water and transported materials remain in the wetland, the greater the likelihood that the materials will be retained. Many wetlands have been constructed as part of stormwater management facilities to treat surface runoff.

Sediment Reduction

Wetlands along rivers, streams and coastal areas are important for removing sediment from surface and tidal waters. During large flood events, rivers frequently overtop their banks and water flows through adjacent floodplains and wetlands. Flood waters carry large volumes of suspended sediment, mostly fine sand, silt and clay. Because floodplains and wetlands provide resistance to flow - from dense vegetation, microtopography, and woody debris - the flow of water is slowed and sediment is deposited and stored in these areas. Similarly, coastal marshes and estuaries retain sediment brought in by tides and residual suspended sediment from rivers.

The ditching and channelization of streams may have limited the access of flood waters to floodplains and adjacent wetlands in Somerset County. Lack of dense vegetation in some floodplains, and narrow width of floodplains, would reduce the ability of wetlands to slow velocities of floodwaters and allow settling of transported sediments.

Wildlife Habitat/Biodiversity

Wetlands provide important habitat for fish, wildlife, and plant species, including rare species. Large contiguous areas of wetland, forest or other relatively undisturbed land are most likely to support sensitive species and diverse, microhabitats. Habitat and biodiversity are threatened not only by direct impacts such as filling, drainage, sediment, and land clearing, but by introduction of exotic and invasive species. Wetlands that are important for habitat and biodiversity often require a relatively undisturbed adjacent buffer to protect the species and habitat from direct and indirect disturbance.

Numerous tidal wetlands in Somerset County have been identified as reference sites as the best examples of certain herbaceous, shrub, and forested community types. These wetlands range of tidal inundation and salinity from irregularly flooded, freshwater

systems to wetlands flooded daily with slightly brackish, oligahaline waters. These wetlands are described in the sections for individual watersheds.

Nontidal Wetlands of Special State Concern

There are several State-designated Nontidal Wetlands of Special State Concern (WSSC) within this County. They are described in the individual watershed sections.

Considerations in Wetland Restoration

This County is dominated by hydric soils. Hydric soils suggest where wetlands are currently or were historically. Sites with hydric soils that are not currently wetlands can often be restored back to wetlands with relative ease. Areas with hydric soils that are not currently wetlands are located throughout the County (with the exception of the far western portion). While most of these soils are classified as "poorly drained," there are also large areas of "very poorly drained" soils that are no longer wetlands.

Wetland restoration and preservation may be another useful tool for achieving TMDL requirements. Wetland restoration designed to achieve maximum water quality benefits towards the TMDL should be focused at the head of tide and upstream. The headwater zone of tidal waterbodies tends to be the location of maximum algal concentrations for several reasons. The tidal headwaters are more stagnant because they tend to be shielded from the wind-generated mixing. This zone is also the depositional area of nutrients from the tidal river's primary nontidal stream system. Finally, this area tends to be shallow. As a consequence, the water tends to be slightly warmer, which increases the rate of algae growth. Additionally, less water volume is available to dilute nutrient fluxes from the bottom sediments (George, 2006, pers. comm.).

Since it is estimated that sea level rise will result in high amounts of land loss in this County, wetland restoration and preservation should consider the long-term effects, as discussed previously.

Since this County is dominated by soils requiring artificial drainage for agriculture and development, it may be especially important to avoid creating/restoring wetlands on soils with good drainage or soils classified as Prime Farmland. Prime Farmland is located mainly in the central and northeastern portion of the County. Most of these Prime Farmland soils do not require irrigation or drainage to be classified as such. Wetland restoration/mitigation should not occur on Prime Farmland (including "Prime Farmland When Drained").

Public Drainage Association (PDA) ditches and artificial drainage are important for the local economy, since the soil is generally too wet to farm without drainage. Many of the soils are ditched. Removing these ditches would improve wetland function. Wetland restoration and mitigation may be possible along PDA ditches. However, it is important that any wetland restoration/creation along the PDAs does not alter upstream agricultural drainage. To restore the hydrology, the wetland drains can be plugged (on-line) or the

wetland can be built adjacent to the ditch (off-line) using a low-level berm (Nichols, pers. comm.). The ideal sites would be those created by plugging the drain. This may be possible at the top of the artificial drainage system, in tidal wetlands, or where these wetlands will not negatively impact upstream agriculture. Unfortunately, in most cases, there is either a perceived or real threat that the upstream drainage will be reduced by restoring an on-line wetland. In these instances, building small berms around the wetland and keeping them off-line (connected through the ditches by an outlet rather than having the wetland encompass the ditch) may prevent the wetland from altering upstream drainage of agricultural land. This second approach is generally more expensive and does not provide as large of a watershed for the wetland, and therefore the wetland provides lower function potential. Water entering the wetland is primarily from stream/ditch overflow during high flow periods and from groundwater.

Vegetated stream buffers have the potential to intercept and remove nutrients, sediments, and other pollutants. Peterson et al. (2001) found that the smallest headwater streams, which are often found in association with springs and groundwater discharge wetlands, have the most rapid uptake and transformation of inorganic nitrogen (ammonium and nitrate) in comparison with other surface waters. The authors believed that the large surface to volume ratio in small streams resulted in rapid nitrogen uptake and processing. An excess of discharges to overload these systems would result in nitrogen being transported farther down the drainage systems to rivers and estuaries. Forested stream buffers can also improve down steam biodiversity by contributing organic matter to the food web, providing woody debris which increases diversity of physical habitat, and reducing stream temperature. Headwater streams are thought to be the most beneficial at these processes. Therefore, wetlands adjacent to streams should be high priority for restoration/preservation, with emphasis on headwater stream systems. Wetlands adjacent to Scenic Rivers and around all tributaries of waterways used for drinking water (COMAR Use P) should also be ranked higher.

DNR assessed the development risk for all land within Maryland. Wetlands within areas of high development risk should be higher priority for preservation.

In order to maintain water quality of surface water reservoirs, wetlands within the watersheds of surface water reservoirs should be higher priority for preservation.

Wetland restoration may be more desirable in land uses that contribute high pollution, currently provide relatively low amounts of biodiversity, and are easy to convert to wetlands. As a general rule, agriculture fits these criteria more than other land use types. Forested land is generally not as high of a pollutant source and it also provides better habitat for plants and wildlife. For these reasons, converting upland forest to wetland may provide fewer benefits than converting agriculture to wetlands. However, projects that have converted artificially drained forest to wetland have resulted in beautiful wetlands with diverse ecology. Additionally, wetlands may be built in urban land use, but they are generally much smaller and sometimes more costly. Urban areas may provide good potential for wetlands designed for storm water management.

MDE has designated some areas as Wellhead Protection Areas (WPAs). In some WPAs, the water table is near the surface, with only a few feet of soil to filter any water entering the ground. Excavation of a few feet would significantly reduce the filtering capacity of the soil, allowing the wetland to act as a direct pathway for nutrients and other pollutants to enter the groundwater. Therefore, wetland creation designs within WPAs should consider the impact to groundwater quality.

Sensitive Resources

Natural Heritage Areas

There are two State-designated Natural Heritage Areas within this County. They are called Irish Grove (Pocomoke Sound watershed) that is partially located within a Maryland Environmental Trust property and Hickory Point Cypress Swamp (Lower Pocomoke watershed) mostly protected by Pocomoke River State Forest. To get this designation, an area must 1) Contain species considered to be threatened, endangered, or in need of conservation; 2) Have unique geology, hydrology, climate or biology; and 3) Be among the best Statewide examples.

Ecologically Significant Areas

There are many DNR-designated Ecologically Significant Areas within this County. These areas have either 1.) federally-listed species, 2.) a State-listed species, or 3.) species or habitat of concern to DNR but not officially listed. These areas generally, but don't always, include Natural Heritage Areas, Nontidal Wetlands of Special State Concern, Colonial Waterbird Colonies, and Habitat Protection Areas. Many of these areas are unprotected, and should be high priority for protection.

Wetland restoration should not be completed in wellhead protection areas. Wetland restoration which increases water movement into the ground water in these areas may also be a conduit for pollutant transport.

The Department of Natural Resources is working on a shoreline erosion project, which includes areas within this County.

Other Relevant Programs

Green Infrastructure and Greenways

A large portion of this County is designated Green Infrastructure. Areas within the GI network that are currently unprotected should be protected. There are also small sections of Green Infrastructure considered to be "gaps," currently in development, agriculture, or barren land. It is desirable to restore these areas back to natural vegetation, as they can provide a wildlife corridor, a protective buffer, and may be especially important along the waterways. For more detailed information, refer to section on the individual watershed.

Rural Legacy Program

Somerset County currently has no Rural Legacy areas

Priority Funding Areas

Priority Funding Areas (PFAs) are spread throughout the County. Some is focused around Rte. 13 and 413 and some around the Dames Quarter Marsh, Deale Island Marsh, and Fairmont Flatland Marsh. Wetland restoration should not be conducted in the PFAs.

Stakeholders in wetland management may have conflicting goals for wetlands in Priority Funding Areas. Some may advocate preserving wetlands in these areas as greenways, for aesthetics, or as unique communities in a developing area. Other interests may seek flexibility and expedited review of proposals to impact wetlands due to other goals for growth and economic development in a designated area. There may be benefits to protecting and restoring wetlands for water quality in a growth area, particularly as an offset against future or existing TMDLs. Preservation of biodiversity may be more of a challenge due to possible increases in nonpoint source pollution and fragmentation. Stormwater management associated with growth may also reduce certain nonpoint source impacts to wetlands in PFAs.

Protected Areas

There is a large amount of protected land in this County, with some of the larger areas in the western portion being Janes Island State Park, Cedar Island WMA, Deal Island WMA, South Marsh Island WMA, Martin National Wildlife Refuge, and Fairmount WMA.

Some properties are within agricultural easements. Some are permanent and some are shorter-term. There is some controversy about conducting wetland restoration within agricultural easements. Most would agree that it is desirable to preserve good farmland. However, properties within these easements may also contain spots of soil with lower productivity due to wetness. These low productivity spots may be a hassle to the farmer and may be good areas for wetland restoration. First, the property owner may be able to benefit from an additional program for that low productivity area, resulting in the owner getting more money for the land and utilizing the land to its full extent. Since these property owners are already involved in a preservation program, they may be more likely to consider additional programs. Second, since some of these agricultural easements are temporary, after the agricultural easement expires, the land owner may decide to get out of agriculture, and a wetland program could help to preserve some of the land from development.

Watershed Information

Information on individual State-designated 8-digit watershed basins is as follows.

Pocomoke Sound (02130201)

Background

This watershed has roughly 34,252 land acres (based on MDP 2002 land use GIS data). Main land uses include forest (42%), agriculture (26%), wetlands (27%), and developed land (5%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR. Large wetlands are focused in the southern portion of this watershed, around Pocomoke Sound. Smaller wetlands are associated with waterways (e.g. along Marmusco Creek, East Creek, Johnson Creek) or scattered throughout the watershed. These wetlands likely provide the functions of water quality improvement, flood attenuation, shoreline stabilization, stream water recharge, and wildlife habitat. Hydric soil suggests where wetlands are currently or were historically. Areas having hydric soil, but that are no longer wetlands, have the potential to be good wetland restoration sites. Within this watershed, most of the soil is classified as hydric, with only about half of these areas currently being wetlands (based on GIS data: NRCS SSURGO, DNR wetlands, NWI wetlands). Most of these hydric soils are classified as "poorly drained."

The Pocomoke River begins in the Great Cypress Swamp north of the MD/DE State line. In Maryland, it meanders southwest for 54 miles before draining into the Pocomoke Sound. Some of the northernmost Bald Cypress swamps and other wetlands border the river along its entire length. This river is the intersection for many northern and southern plants. The river generally has only a loosely defined bank and is often buffered by dense forest swamp. This river is home to the Delmarva Fox Squirrel, wood ducks, and other wildfowl. The lower Pocomoke is brackish up to Pocomoke City. This brackish area is a good shellfish, fish, and other aquatic life nursery and harvesting area. The river is tidal between the Pocomoke Sound to above Whiton's Crossing (roughly 41 miles). The high amount of recreation occurring on the River may become a threat to the resource (MDP, 1981)
Estimates of wetland acreage for the entire Maryland portion of the watershed, based on DNR mapped wetlands, are as follows:

- Estuarine
    - Emergent: 8,957 acres
    - Scrub shrub: 288 acres
    - Forested: 476 acres
    - Flat: 2 acres
    - Unconsolidated shore: 82 acres
- Palustrine
    - Emergent: 361 acres
    - Scrub shrub: 398 acres
    - Forested: 2,841 acres
    - Unconsolidated bottom: 59 acres
    - Farmed: 107 acres
- Total: 13,571 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight loss in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130201	-0.45	0	0	0	-0.45

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. All estuarine portions (except Fair Island Canal) are designated Use II, shellfish harvesting.

Water Quality

The 1998 Clean Water Action Plan classified the watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. This watershed is also classified as Category 3, a watershed in need of protection. Failing indicators include high nutrient concentrations, poor SAV abundance, high historic wetland loss (24,264 acres), and being listed on the 303(d) for water quality impairments. Indications for category 3 include a migratory fish spawning area and a high amount of wetland dependent species.

According to the 2002 Maryland Section 305(b) Water Quality Report, a portion of the Pocomoke Sound and tidal creeks do not support all designated uses (21.8 $mi.^2$ fully supports, 2.3 $mi.^2$ do not fully support) due to elevated levels of bacteria from nonpoint sources.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Pocomoke Sound* (tidal); fecal coliform, poor biological community.

The only MBSS site in this watershed found BIBI of very poor (Marumsco Creek).

Restoration/Preservation

There is a large hub in the southern part of this watershed, covering about half of the land. It is partially protected by Maryland Ornithological Society land, Pocomoke Sound WMA, and DNR-owned Chesapeake Forest land. Large portions of this hub are still unprotected. There are some GI "gaps" around Marumsco that may provide good locations for restoration to natural vegetation. According to the Maryland Greenways Commission document, designated existing and proposed greenways include:

- *Pocomoke Sound Greenway*. This is an existing ecological greenway connecting Pocomoke Sound WMA, Maryland Ornithological Society land, and Cedar Island WMA.
- *Westover to Crisfield Rail Trail*. This is a proposed recreational greenway along the Pennsylvania Railroad.

A partnership the Department of Natural Resources, U.S. Fish and Wildlife Service (FWS), and the Nature Conservancy established a goal to protect and restore riparian habitat on the mainstem and tributaries of the Pocomoke River in Wicomico, Worcester, and Somerset Counties. In March 2006, Maryland submitted a North American Wetland Conservation Act (NAWCA) Grant Proposal to FWS to purchase conservation easements from three willing landowners on properties with a total of 1187.5 acres of riparian forest, forested wetlands, and farmland. Approximately 655 acres of forested wetland will be enhanced by breaching a berm to allow
improved access of the river to its floodplain (Murphy, 2006, pers. comm.).

As part of an ongoing project to classify the vegetative communities in Maryland, DNR created the document entitled *Shrubland Tidal Wetland Communities of Maryland's Eastern Shore* (Harrison and Stango, 2003). In this document, they categorize nine shrubland tidal wetland communities, including some in Somerset County. One of the reference sites, the best example of a particular community type, is the *Iva frutescens/Spartina patens* tidal wetland in Richardson Marsh. This community type is ranked S5: "a designation meaning that this community is demonstrably secure in Maryland under the present conditions." This site is threatened from invasion by *Phragmites*. Richardson Marsh also supports reference tidal wetland community of *S. alterniflora* (smooth cordgrass). Rumbly Point supports the tidal wetland reference communities of *I. frutescens/S. patens* and *Baccharis halmifolia-Iva frutescens/Panicum virgatum* (Groundsel tree-Marsh elder/Switch grass). Both communities are found in mesohaline waters, with daily to irregular tidal inundation, with variable microtopography that may include hummocks or nearly flat areas. The reference shrub community *I. frutescens/S. cynosuroides* (Marsh elder/Big cordgrass) is also found in Pocomoke Sound in oligohaline to mesohaline waters, with daily to irregular tidal inundation.

Irish Grove is a designated Natural Heritage Area within this watershed. To get this designation, an area must contain threatened or endangered species and be one of the best Statewide examples.

There is one State-designated Nontidal Wetland of Special State Concern (WSSC) within this watershed. Shelltown Ponds is located in the southeast corner of the watershed, around Fair Island Lane. One of the ponds is owned by DNR as part of the Chesapeake Forest Land. The remaining portion of the wetland is not protected.

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.

- Restore area within Green Infrastructure gaps back to natural vegetation, especially within the large GI hub and along the waterways (e.g. East Creek and Marumsco Creek).
- Restore riparian habitat on Pocomoke River mainstem and tributaries.

Specific preservation recommendations:

- Protect wetlands and streams within the headwaters.
- Protect areas within the Green Infrastructure network that are unprotected (e.g. Richardson Marsh, Marumsco Marsh and Creek, and Longford Marsh).
- Protect the WSSC and buffers.
- Protect DNR-designated Ecologically Significant Areas containing wetlands that are unprotected
    - e.g. the lower portion of Marumsco Creek
    - the remaining unprotected portion of Irish Grove NHA (including Richardson Marsh, Longford Marsh, and the confluence of East Creek and Tulls Branch).
- Protect tidal wetlands used as reference sites in DNR's study of wetland vegetative communities (Harrison and Stango, 2003).
- Protect riparian habitat on Pocomoke River mainstem and tributaries.

<u>Lower Pocomoke River (02130202)</u>

Background

The Somerset County portion of this watershed has 18,980 land acres (based on MDP 2002 land use GIS data). Land use is dominated by agriculture (44%) and forest (48%), with smaller amounts of wetlands (4%) and developed land (4%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR.

Wetlands are scattered throughout this watershed, with higher amounts along the Pocomoke River and tributaries (e.g. along Rehoboth Branch and Costen Branch). These wetlands likely provide the functions of water quality improvement, flood attenuation, stream recharge, and wildlife habitat. Hydric soil suggests where wetlands are currently or were historically. Areas having hydric soil, but that are no longer wetlands, have the potential to be good wetland restoration sites. Within the Somerset County portion of this watershed, roughly half of the soil is classified as hydric, with few of these areas currently being wetlands (based on GIS data: NRCS SSURGO, DNR wetlands, NWI wetlands). These are mostly "poorly drained" and are located at the mouth of the Pocomoke River and in the northwest portion of the watershed. There are also some "very poorly drained" soils in the northern portion.

The Pocomoke River begins in the Great Cypress Swamp north of the MD-DE State line. In Maryland, it meanders southwest for 54 miles before draining into the Pocomoke Sound. Some of the northernmost Bald Cypress swamps and other wetlands border the

river along its entire length. This river is the intersection for many northern and southern plants. The river generally has only a loosely defined bank and is often buffered by dense forest swamp. This river is home to the Delmarva Fox Squirrel, wood ducks, and other wildfowl. The lower Pocomoke is brackish up to Pocomoke City. This brackish area is good nursery and harvesting area for shellfish, fish, and other aquatic life. Above Pocomoke City, there is great fishing and hunting. The river is tidal between the Pocomoke Sound to above Whiton's Crossing (roughly 41 miles). The high amount of recreation occurring on the River may become a threat to the resource (MDP, 1981). The Pocomoke River below Pocomoke City is still fairly pristine in appearance, while above Porter's Crossing, much of the surrounding swamp has been channelized and ditched (Sipple, 1999).

Estimates of wetland acreage for the entire Maryland portion of the watershed, based on DNR mapped wetlands, are as follows:

- Estuarine
  - Emergent: 1,621 acres
  - Scrub shrub: 55 acres
  - Unconsolidated shore: <1 acres
- Palustrine
  - Emergent: 800 acres
  - Scrub shrub: 911 acres
  - Forested: 17,459 acres
  - Unconsolidated bottom: 304 acres
  - Farmed: 178 acres
- Riverine emergent: 7 acres
- Total: 21,337 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for the entire Maryland portion of the watershed, there has been a gain in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130202	-5.61	4.77	21.30	0.41	20.87

Code of Maryland Regulations

All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. All estuarine portions (except Fair Island Canal and Pocomoke River above the MD/VA line) are designated Use II, shellfish harvesting.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resources goals and therefore

needing restoration. Since it is a "Priority" Category 1 watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include high nitrogen and phosphorus loads, poor SAV abundance, low SAV habitat index, low benthic IBI, high amount of historic wetland loss (71,922 acres), high soil erodibility (0.31), and being on the 303(d) List for water quality impairment. Indicators of Category 3 include a high imperiled aquatic species indicator, containing four migratory fish spawning areas, a high percent of the watershed being forested (56%), and State-designated Wildlands (3,912 acres).

According to the 2002 Maryland Section 305(b) Water Quality Report, the Lower Pocomoke River and tidal tributaries (from the mouth to Snow Hill) fail to fully support all designated uses due to low oxygen and elevated levels of bacteria from sources of municipal discharges, agriculture, non-point, natural, eutrophication, and blackwater. The 2002 305(b) also reports that some of the nontidal wadeable streams (i.e. Jones Ditch sub-watershed; DNR, 2000) do not fully support all designated uses due to the poor biological community from low oxygen and siltation.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Lower Pocomoke River* (tidal); fecal coliform, nutrients, sediments.
- *Jones Ditch* (021302020632 non-tidal in Worcester County); sedimentation.
- *Kelly Mill Branch* (021302020633 non-tidal in Worcester County); poor biological community.
- *Corkers Creek* (021302020633 non-tidal in Worcester County); poor biological community.
- *Wagnam Creek* (021302020628 non-tidal in Worcester County); poor biological community.
- *Wagnam Creek Unnamed Tributary* (021302020628 non-tidal in Worcester County); poor biological community.
- *Wagnam Swamp Branch* (021302020628 non-tidal in Worcester County); poor biological community.
- *Rehobeth Branch* (021302020625 non-tidal in Somerset County); poor biological community.
- *Poorhouse Branch* (021302020639 non-tidal in Worcester County); poor biological community.
- *Puncheon Landing Branch* (021302020627 non-tidal in Somerset County); poor biological community.

Restoration/Preservation

This watershed has Green Infrastructure hubs and corridors throughout. Some of the GI land in the north is protected by DNR-owned Chesapeake Forest land while the GI land is south is unprotected. Large unprotected areas along the Pocomoke should be high priority

for protection. The area around Rehobeth is GI "gap" and may be a desirable location for restoration to natural vegetation. The Maryland Greenways Commission proposed the Pocomoke River Regional Greenway along the river.

The Pocomoke River was designated as a Scenic River by the Maryland General Assembly.

There is one State-designated Nontidal Wetland of Special State Concern (WSSC) within this watershed. This site is also a Natural Heritage Area. To get this designation, an area must contain threatened or endangered species and be the best Statewide example. Hickory Point Cypress Swamp NHA is located along a bend in the Pocomoke River, south of Vessey Orchard Road. The portion within Worcester County is protected within Pocomoke River State Forest. The portion in Somerset County is unprotected.

A partnership of the Department of Natural Resources, U.S. Fish and Wildlife Service (FWS), and the Nature Conservancy established a goal to protect and restore riparian habitat on the mainstem and tributaries of the Pocomoke River in Wicomico, Worcester, and Somerset Counties. In March 2006, Maryland submitted a North American Wetland Conservation Act (NAWCA) Grant Proposal to FWS to purchase conservation easements from three willing landowners on properties with a total of 1187.5 acres of riparian forest, forested wetlands, and farmland. Approximately 655 acres of forested wetland will be enhanced by breaching a berm to allow improved access of the river to its floodplain (Murphy, 2006, pers. comm.).

A tidal freshwater wetland reference community of *Morella cerifera-Rosa palustris*/*Thelypteris palustris* (Wax myrtle-Swamp rose/Royal fern) is found along the Pocomoke River. Communities of this type occasionally receive higher salinity during seasonal high tides and are characterized by hummock and hollow microtopography (Harrison and Stango, 2003).

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.
- Restore "gaps" within the designated Green Infrastructure back to natural vegetation, including the Rehobeth GI hub and along waterways (e.g. Rehobeth Branch, Costen Branch, and Pocomoke River around Pocomoke City).
- Restore riparian areas around the Pocomoke River and tributaries.

Specific preservation recommendations:

- Protect wetlands and streams within the headwaters.
- Protect areas within Green Infrastructure that are unprotected, especially along the Pocomoke River and tributaries.
- Protect the designated WSSC and surrounding buffers.
- Protect the Scenic Pocomoke River and tributaries.
- Protect DNR-designated Ecologically Significant Areas containing wetlands that are unprotected, including:
    - East of Powell Wharf Road

  - Around Shelltown
  - North of Shelltown
  - Around Rehobeth
- Protect tidal wetlands used as reference sites in DNR's study of wetland vegetative communities (Harrison and Stango, 2003).

Dividing Creek (02130204)

Background

The Somerset County portion of this watershed has 10,345 land acres (based on MDP 2002 land use GIS data). Over half of the land use is forest (61%), about a third is agriculture (37%), and a small remaining amount is developed land (2%). Wetlands are concentrated along Dividing Creek and scattered throughout this watershed. These wetlands likely provide the functions of water quality improvement, flood attenuation, stream recharge, and wildlife habitat. While some of these wetlands are associated with streams, many are not. Hydric soil suggests where wetlands are currently or were historically. Areas having hydric soil, but that are no longer wetlands, have the potential to be good wetland restoration sites. Within the Somerset County portion of this watershed, roughly half of the soil is classified as hydric, with few of these areas currently being wetlands (based on GIS data: NRCS SSURGO, DNR wetlands, NWI wetlands). Most soils are classified as "poorly drained," but there are also areas classified as "very poorly drained."

Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Palustrine
  - Emergent: 127 acres
  - Scrub shrub: 360 acres
  - Forested: 9,200 acres
  - Unconsolidated bottom: 22 acres
  - Farmed: 56 acres
- Total: 9,765 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight loss in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130204	-0.11	0	0	0	-0.11

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. This watershed is designated Use I, recreation contact and protection of aquatic life.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. It is also classified as a Category 3, a watershed in need of protection. Failing indicators include a high amount of historic wetland loss (34,709 acres), high soil erodibility (0.28), and being on the 303(d) List for water quality impairment. Indicators for Category 3 include a high amount of headwater streams occurring in Interior Forests (35%) and a high percent of the watershed being forested (73%).

According to the 2002 Maryland Section 305(b) Water Quality Report, water quality results for Dividing Creek and tributaries were inconclusive.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Dividing Creek* (non-tidal); fecal coliform.
- *Dividing Creek* (tidal); nutrients, suspended sediments.
- *Tony Creek* (021302040663 non-tidal in Somerset County); poor biological community.
- *Miller Branch* (021302040665 non-tidal in Worcester County); poor biological community.

MBSS found BIBI of fair and very poor (Tony Creek) and FIBI of good to fair.

Restoration/Preservation

The majority of this watershed is part of a huge Green Infrastructure hub continuing into Worcester County. Some of this hub is protected by DNR-owned Chesapeake Forest land but large areas along Dividing Creek are still unprotected.

The Pocomoke River was designated as a Scenic River by the Maryland General Assembly.

A partnership of the Department of Natural Resources, U.S. Fish and Wildlife Service (FWS), and the Nature Conservancy established a goal to protect and restore riparian habitat on the mainstem and tributaries of the Pocomoke River in Wicomico, Worcester, and Somerset Counties. In March 2006 Maryland submitted a North American Wetland Conservation Act (NAWCA) Grant Proposal to FWS to purchase conservation easements from three willing landowners on properties with a total of 1187.5 acres of riparian forest, forested wetlands, and farmland. Approximately 655 acres of forested wetland will be enhanced by breaching a berm to allow improved access of the river to its floodplain (Murphy, 2006, pers. comm.).

There are no State-designated Nontidal Wetlands of Special State Concern in the Somerset portion of this watershed.

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.
- Restore "gaps" within the Green Infrastructure back to natural vegetation.
- Restore riparian habitat around the Pocomoke River and tributaries.

Specific preservation recommendations:

- Protect wetlands and streams within the headwaters.
- Protect areas within the Green Infrastructure network that are unprotected, especially along Diving Creek (e.g. Richardson Marsh, Marumsco Marsh and Creek, and Longford Marsh).
- Protect DNR-designated Ecologically Significant Areas containing wetlands that are unprotected, for example:
    - The mouth of Dividing Creek
    - The confluence of Tonys Creek and Dividing Creek
- Protect the Pocomoke River and tributaries.

<u>Tangier Sound (02130206)</u>

Background

This watershed had roughly 15,313 land acres (based on MDP 2002 land use GIS data). The majority of land use is wetland (73%), with the remaining land use being developed land (15%), forest (8%) and agriculture (4%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR. Most of the land is wetland, with exception being along the western shore of Deal Island and around Crisfield. These wetlands likely provide the functions of water quality improvement, flood attenuation, shoreline stabilization, and wildlife habitat. Hydric soil suggests where wetlands are currently or were historically. Areas having hydric soil, but that are no longer wetlands, have the potential to be good wetland restoration sites. Within this watershed, virtually all of the soil is classified as hydric, with most of these areas currently being wetlands (based on GIS data: NRCS SSURGO, DNR wetlands, NWI wetlands). Most soils are "poorly drained," but there are also areas of "very poorly drained." Wetland restoration in these remaining areas may be limited by development, since the only areas not in wetlands are in higher development areas.

Estimates of wetland acreage for the entire Maryland portion of the watershed, based on DNR mapped wetlands, are as follows:

- Estuarine
    - Emergent: 10,877 acres
    - Forested: 80 acres
    - Scrub shrub: 51 acres
    - Flat: 322 acres

    - Unconsolidated shore: 273 acres
- Palustrine
    - Emergent: 34 acres
    - Scrub shrub: 81 acres
    - Forested: 503 acres
    - Unconsolidated bottom: 5 acres
    - Farmed: 28 acres
- Total: 12,254 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight loss in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130206	-0.26	0	0	0.04	-0.22

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. All estuarine portions (except Jenkins Creek) are designated Use II, shellfish harvesting.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. It is also classified as a Category 3, watershed in need of protection. Failing indicators include a low SAV abundance and being on the 303(d) List for water quality impairment. Indicators for Category 3 include a high amount of wetland-dependent species and State-designated Wildlands (2,723 acres).

According to the 2002 Maryland Section 305(b) Water Quality Report, portions of Tangier Sound fail to fully support all designated uses (57.2 $mi.^2$ support, 60.2 $mi.^2$ fail to support) due to low oxygen and elevated levels of bacteria from sources of non-point, natural, and deep Chesapeake Bay water.

The 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Tangier Sound* (tidal); nutrients (and seasonally low dissolved oxygen), poor biological community, suspended sediments.
- *Laws Thorofare, Upper Thorofare* (021302060617 tidal); fecal coliform.

Restoration/Preservation

This entire watershed is designated Green Infrastructure except Crisfield and west of Deal Island WMA. Large protected areas include Deal Island WMA, Janes Island WMA, Cedar Island WMA, and some smaller METs. There are still some unprotected areas south of Deal Island WMA and south of Crisfield. According to the Maryland Greenways Commission document, designated existing and proposed greenways include:

- *Janes Island State Park and Water Trail*.
- *Tangier Sound Greenway*.
- *Pocomoke Sound Greenway*. This is an existing ecological greenway connecting Pocomoke Sound WMA, Maryland Ornithological Society land, and Cedar Island WMA.
- *Westover to Crisfield Rail Trail*. This is a proposed recreational greenway along the Pennsylvania Railroad.

There are numerous herbaceous (emergent), shrub, and forested tidal wetland communities in this watershed. Most are found on Janes Island, Deal Island, and Cedar Island. The herbaceous community is *Juncus roemerianus* (black needlerush) found in low brackish marshes. The shrub community *Iva frutescens/S. patens* (Marsh elder/saltmeadow cordgrass) is found in mesohaline waters, with daily to irregular tidal inundation, and variable microtopography that may include hummocks or nearly flat areas. The *Baccharis halmifolia-Iva frutescens/Panicum virgatum* (Groundsel tree-Marsh elder/Switch grass) are found in similar environments. A forested tidal wetland community of *Pinus taeda/Morella cerifera/S. patens* (Loblolly pine/Wax Myrtle/Saltmeadow cordgrass) is also present. This is another mesohaline system that is usually flooded less than once daily (Harrison, 2001; Harrison and Stango, 2003; Harrison et al., 2004).

There are no State-designated Nontidal Wetlands of Special State Concern in this watershed.

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.
- Restore “gaps” in the Green Infrastructure back to natural vegetation.

Specific preservation recommendations:

- Protect wetlands and streams within the headwaters.
- Protect areas within the Green Infrastructure network that are unprotected (e.g. Deal Island, east of Cedar Island WMA, and around Jenkins Creek).
- Protect DNR-designated Ecologically Significant Areas containing wetlands that are unprotected
    - South of Little Deal Island (from ADC map, appears to be in the water).
    - Small island near the confluence of Laws Thorofare and Big Sound Creek.
- Protect tidal wetlands used as reference sites in DNR’s study of wetland vegetative communities (Harrison and Stango, 2003).

<u>Big Annemessex River (02130207)</u>

Background

This watershed has roughly 22,231 land acres (based on MDP 2002 land use GIS data). Land use is divided into forest (41%), agriculture (26%), and wetlands (27%), with the remaining amount being developed land (7%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR. This watershed has moderate development pressure (Greenhorne & O'Mara, Inc, 1993). There is currently an extensive agricultural ditch network that has reduced wetland acreage.

Wetlands are located around the Big Annemessex River, with largest wetlands around the mouth of the river. Other smaller wetlands are located around tributaries or not associated with a waterway. These wetlands likely provide the functions of water quality improvement, flood attenuation, shoreline stabilization, stream recharge, and wildlife habitat. Hydric soil suggests where wetlands are currently or were historically. Areas having hydric soil, but that are no longer wetlands, have the potential to be good wetland restoration sites. Within this watershed, most of the soil is classified as hydric, with only about half of this area currently being wetlands (based on GIS data: NRCS SSURGO, DNR wetlands, NWI wetlands). Most soils are "poorly drained," but there are also areas of "very poorly drained."

Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Estuarine
    - Emergent: 5,390 acres
    - Scrub shrub: 122 acres
    - Forested: 77 acres
    - Flat: 201 acres
    - Unconsolidated shore: 151 acres
- Palustrine
    - Emergent: 146 acres
    - Scrub shrub: 195 acres
    - Forested: 1,000 acres
    - Unconsolidated bottom: 79 acres
    - Farmed: 82 acres
- Total: 7,444 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight gain in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130207	-2.98	3.45	0	0	0.48

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. All estuarine portions (except Big Annemessex River and tributaries above River Road) are designated Use II, shellfish harvesting.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. It is also classified as a Category 3, watershed in need of protection. Failing indicators include low SAV abundance, poor SAV habitat index and poor anadromous fish index. Indicators for Category 3 include high tidal fish IBI, presence of a migratory fish spawning area, and a high amount of wetland dependent species.

According to the 2002 Maryland Section 305(b) Water Quality Report, a very small portion of Big Annemessex River fails to fully support all designated uses (11.2 $mi.^2$ support, 0.1 $mi.^2$ fail to support) due to low oxygen and elevated levels of bacteria from sources of non-point, natural, and eutrophication.

There are no waterbodies within this watershed on the 303(d) List for water quality impairment.

The following information is based on the document entitled *Assessment of the Biological Communities in the Tidal Portions of the Big Annemessex River 1995-1996*. Data was collected from four stations within the Big Annemessex River and compared with data from two other waterways: South River (a stressed urban system) and Wicomico River (reference with data back to 1989). Communities within Big Annemessex River are similar to areas with minimal habitat impairment. TSS has been increasing over time and may begin to inhibit SAV growth in some areas.

Restoration/Preservation

There are some large hubs around Annemessex River, partially protected by DNR-owned Fairmount WMA, Janes Island WMA, and Chesapeake Forest land. Some large unprotected GI hubs include east of Fairmount WMA and east of Janes Island WMA. According to the Maryland Greenways Commission document, designated existing and proposed greenways include:

- *Janes Island State Park and Water Trail*.
- *Tangier Sound Greenway*.
- *Westover to Crisfield Rail Trail*. This is a proposed recreational greenway along the Pennsylvania Railroad.

The following information is based on the 1993 document entitled *Big Annemessex River Nontidal Wetlands Watershed Management Plan*. Within this watershed they identified

294 nontidal wetlands, 85 wet farms, and 19 riverine systems. The most common wetland type was palustrine forested (69% of the acreage). While the wet farm sites are not jurisdictional wetlands, they may be potential sites for restoration. Identified wetlands were assessed for wetland function and results were mapped within the document. The wetlands provided very little groundwater discharge function. When this document was published, there were 164.9 acres of wetlands located within the planned growth areas, areas that may be at high risk for wetland loss/impacts due to development. Of these, 58% were rated as High Value wetlands. This document assessed impacts of future development in the planned growth areas on the wetlands, including suggesting revisions to Marion Primary Growth Area, Westover Primary Growth Area, and Fairmount Secondary Growth Area. Possible mitigation sites were identified on non-forested sites that satisfied at least one of the following criteria: adjacent to other wetlands, identified as a potential mitigation site or palustrine farmed site (photointerpretation based on wet soils), $\geq$ 50% of the soils are Pocomoke or Portsmouth.

Iva frutescens/S. patens (Marsh elder/saltmeadow cordgrass) is found in mesohaline waters, with daily to irregular tidal inundation, and variable microtopography that may include hummocks or nearly flat areas. The *Baccharis halmifolia-Iva frutescens/Panicum virgatum* (Groundsel tree-Marsh elder/Switch grass) are found in similar environments (Harrison, 2001; Harrison and Stango, 2003).

There are no State-designated Nontidal Wetlands of Special State Concern in the Somerset portion of this watershed.

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.
- Restore "gaps" in the Green Infrastructure back to natural vegetation.
- Restore sites identified within the *Big Annemessex River Nontidal Wetlands Watershed Management Plan*.

Specific preservation recommendations:

- Protect wetlands and streams within the headwaters.
- Protect areas within the Green Infrastructure network that are unprotected, especially the GI hub around the Big Annemessex River.
- Protect DNR-designated Ecologically Significant Areas containing wetlands that are unprotected, including around Wear Point.
- Protect areas designated as "High Value" wetlands in the *Big Annemessex River Nontidal Wetlands Watershed Management Plan*.
- Protect tidal wetlands used as reference sites in DNR's study of wetland vegetative communities (Harrison and Stango, 2003).

Manokin River (02130208)

Background

Based on MDP 2002 land use GIS data, land use in this watershed is mainly agriculture (31%) and forest (44%). There is also a fair amount of wetlands (19%) and some developed land (6%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR. Developed land is mainly located in Princess Anne. There is a large amount of wetlands in this watershed. There are large wetland systems around the Manokin River. Other wetlands are located along the upstream Manokin River and tributaries (e.g. Back Creek, Kings Creek, Taylor Branch, Jones Creek, Hall Branch, Goose Creek). Other wetlands do not appear to be directly associated with a waterway. These wetlands likely provide the functions of water quality improvement, flood attenuation, shoreline stabilization, stream recharge, and wildlife habitat. Many wetlands have been ditched, which may alter how they function. Hydric soil suggests where wetlands are currently or were historically. Areas having hydric soil, but that are no longer wetlands, have the potential to be good wetland restoration sites. Within this watershed, over half of the soil is classified as hydric (based on GIS data: NRCS SSURGO, DNR wetlands, NWI wetlands). Most soils are "poorly drained," but there are also areas of "very poorly drained." While many of these hydric soils are currently wetlands, some are not.

This waterway drains directly to the Chesapeake Bay. There are roughly 59,400 acres of land in the entire watershed (including areas outside of this County). About half of this land is wetland and most of the remaining land is hydric (Shanks, 2001). There is also roughly 14,900 acres of open tidal water. Extensive draining, including Public Drainage Associations (PDAs) is important to the local economy since only about 10% of the soil can be farmed without drainage. Of the land acreage, about 16% of the entire watershed is considered prime farmland based on the Natural Soil Groups.

Ditching wetlands to create agricultural land is quite common. The confluence of St. Peters Creek and Manokin Creek is surrounded by wetlands (MDE, 2000a).

The oyster population is much smaller than historic levels, likely due to disease, habitat loss, sedimentation, and poor water quality (Shanks, 20001).

The DNR State Erosion Task Force found that Somerset County erosion is very high in some areas. Maryland Geological Survey mapped historic shoreline change, finding that most extensive change occurred adjacent to the large water bodies (Shanks, 2001).

Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Estuarine
    - Emergent: 10,751 acres
    - Scrub shrub: 141 acres
    - Forested: 248 acres
    - Flat: 3 acres
    - RF: 12 acres
    - Unconsolidated shore: 113 acres

- Palustrine
  - Emergent: 2,216 acres
  - Scrub shrub: 1,742 acres
  - Forested: 11,419 acres
  - Unconsolidated bottom: 89 acres
  - Farmed: 189 acres
- Total: 26,922 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight loss in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130208	-2.56	0.77	0	0.38	-1.41

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. All estuarine portions (except Manokin River and tributaries above Kings Creek) are designated Use II, shellfish harvesting.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. Since it is a "Priority" Category 1 watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. It is also classified as a Category 3, a watershed in need of protection. Failing indicators include high nutrient concentrations, low SAV abundance, poor SAV habitat index, poor non-tidal benthic IBI, a high amount of historic wetland loss (43,036 acres), and being on the 303(d) List for water quality impairment. Indicators for Category 3 include a high imperiled aquatic species indicator, two migratory fish spawning areas, and a high amount of wetland-dependent species.

According to the 2002 Maryland Section 305(b) Water Quality Report, a small portion of the Manokin River fails to fully support all designated uses (22.6 $mi.^2$ support, 2.8 $mi.^2$ fail to support) due to low oxygen, elevated levels of bacteria, and nutrients from sources of municipal discharge, non-point (agriculture and urban), and natural.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Manokin River* (tidal); suspended sediments.
- *Manokin River* (tidal); fecal coliform.

- *St. Peter's Creek* (tidal); fecal coliform.
- *St. Peter's Creek* (021302080657 tidal); fecal coliform.

The following information is from the 2000 MDE document entitled *Total Maximum Daily Loads of Nitrogen and Biochemical Oxygen Demand for Manokin River, Somerset County, Maryland*. The Manokin River above Kings Creek is Use I and below Kings Creek is Use II. These designations require a dissolved oxygen level of 5ug/l at all times (except due to natural causes). This waterway has low dissolved oxygen (<5 ug/l) and high algae. Sources of nutrients include: nitrogen - agriculture (57%), forest/herbaceous (23%), urban (8%), atmospheric deposition (7%), and point sources (5%); phosphorus – agriculture (81%), forest/herbaceous (7%), atmospheric deposition (6%), urban (4%), and point sources (2%). Point sources include a WWTP for the Town of Princess Anne (discharging to river in upstream section), Eastern Correctional Institute WWTP (discharging to river below Kings Creek), Goose Creek Food Store WWTP (discharging to headwaters of Back Creek). Water samples show the Manokin River mainstem and tributaries have occurrences of dissolved oxygen <5 ug/l. Biochemical oxygen demand is highest in the headwaters with a few additional high occurrences in Back Creek and Kings Creek. Chlorophyll a is highest in the upstream sections and dissolved inorganic nitrogen is also highest in the headwaters and Kings Creek. The TMDL for the Manokin River requires a 33% reduction in average annual controllable nitrogen, a 24% reduction in low flow controllable nitrogen, and a 26% low flow reduction in BOD.

A Draft TMDL was completed in 2005 for fecal coliform in restricted shellfish harvesting areas within the Manokin River (the upper portion of the Manokin River) and St. Peter's Creek (a small subwatershed flowing into the mouth of the Manokin River). Within the Manokin River and St. Peter's Creek Basins, the main source of fecal coliform was from livestock (99%).

Maryland Department of Natural Resources developed the Watershed Characterization for Manokin Watershed in 2001. The following information is summarized from that document. There were two MBSS sites within this watershed in 1997, Kings Creek and Loretto Branch. For fish IBI, both sites were ranked "fair." For benthic IBI, Kings Creek was ranked "very poor" and Loretto Branch was ranked "fair." DNR ranked King Creek subwatershed as "moderately high" for rare fish or mussel species. Restoration or protection projects in this area has the potential to protect these sensitive resources. Toxic forms of Pfiesteria, often associated with high nutrient and chlorophyll levels, were present in Kings Creek in 1997 (Tango, 2000). The Lower Eastern Shore Tributary Team found water clarity in the Manokin River from 1985 through 1999 to be degrading. Water quality characterizations were based on data from the Chesapeake Bay Program, MDE, UMES, and MBSS. Summer dissolved oxygen was low upstream of the Manokin River and Back Creek confluence. High BOD concentrations were found in Manokin River (just downstream of Princess Anne), Kings Creek (downstream), and Back Creek (downstream of Rte. 13). High chlorophyll a concentrations were found at Manokin River (between Taylor Branch and Princess Anne), Kings Creek (between Manokin River and Rte. 13), and Back Creek (downstream of Rte. 13). Highest algae concentrations in Manokin River were found at the mouth of Kings Creek. According to a DNR report, this

area (Manokin River and Kings Creek) had some of the highest algae levels in the Lower Eastern Shore (Magnien et al., 2000). High nutrient (TN and TP) concentrations were found downstream of Princess Anne and high TP were found in Kings Creek (at Rte. 13) and Back Creek (downstream of Rte. 13). Compared to other similar Chesapeake Bay watersheds, Kings Creek ranked among the highest for organic carbon, total nitrogen, total phosphorus, and dissolved organic phosphorus (DNR, 1998).

Water quality samples taken in 1997 through 1999 found high nutrient levels in Taylor Branch and nitrate levels exceeding drinking water standards at Westover Spring (Jesien, 1999).

Restoration/Preservation

The Manokin watershed stream corridor survey conducted in 2001 surveyed 90 miles of non-tidal streams and 5,205 acres of tidal stream. They found 109 problems. The most common issue was poor riparian buffer (59 sites or ~23 miles). The very severe sites were located in the headwaters (e.g. Kings Creek, Manokin Branch, and Loretta Branch), mostly next to row crops. Less severe sites are due to pastures, logging, or lawns. There were many channelized streams (18 sites or ~8 miles) in the headwaters (e.g. Kings Creek, Manokin Branch, Loretta Branch). Most of these sites were maintained agricultural ditched designed to lower the water table. There were a number of altered shorelines (14 sites) mostly along the Manokin River. These included bulkheads, rip-rap, and artificial beach, generally adjacent to lawn. Often when the natural forest is replaced with lawn, these structures become necessary for erosion control. There were a few spots of erosion (7 sites), ranked minor to moderate severity, located in Kings Creek and Manokin Branch. Of the encountered fish blockages (4 sites), the two most severe were weirs. One of these (ranked severe) is a USGS gauging station at Princess Anne. A 2001 UMES fish survey found river herring, yellow perch, and white perch in Manokin Branch below this site. It is possible that upstream movement of these fish is limited by the blockage. Other possible problems identified included a pipe outfall and an active construction site. All problem sites are ranked based on problem severity, ease of correctability, and ease of access. This information can be very useful in selecting sites for restoration. They also surveyed representative sites throughout the watershed for habitat conditions.

The following information is based on the 2002 WRAS. University of Maryland Eastern Shore is currently working on a project to survey anadromous fish in Manokin River, Kings Creek, Back Creek, and Taylor Branch. Some recommendations include:

- *Conduct research*: marsh loss due to erosion, impact of drainage ditches, water quality, runoff, aquatic life, oyster bed restoration, feasibility of dredging to increase bay access.
- *Encourage agricultural BMPs*: grass buffers on PDAs, tree plantings around poultry houses, nutrient management plans, cover crops.
- *Encourage riparian buffers and forest plantings*: Encourage citizen involvement.
- *Educate*: septic systems, lawncare.

- *Promote ecotourism and recreation*: greenway/blueway along Manokin River (stretching from UMES to Raccoon Point), "marinas" for canoes.

The goals of the Land Planning and Recreation Plan include: protecting waterways, wetlands, agriculture, forest, and historic areas.

There are some large Green Infrastructure hubs on the east and west sides of the watershed, partially protected by DNR-owned Deal Island WMA, Fairmount WMA, Wellington WMA, and Chesapeake Forest Land. Large unprotected GI hubs still remain around Fairmount WMA and east of Princess Anne. GI "gaps" along the Manokin River should be high priority for restoration to natural vegetation. According to the Maryland Greenways Commission document, designated existing and proposed greenways include:

- *Tangier Sound Greenway*. This is an existing ecological and recreational greenway connecting several protected properties.
- *Manokin River Greenway*. This proposed ecological and recreational greenway would connect Princess Anne with Raccoon Point Recreation Area (at the Manokin River mouth).
- *Manokin River Water Trail*. This is a potential water trail.

As part of an ongoing project to classify the vegetative communities in Maryland, the DNR document entitled *Herbaceous Tidal Wetland Communities of Maryland's Eastern Shore* characterizes 14 community types, with some being found in this County. A reference site, the best example of a particular community type, *Juncus roemerianus* tidal herbaceous vegetation is located in Dames Quarter Marsh. This community type was designated S4, a community type being "secure under present conditions in Maryland." This site is at risk for invasion by *Phragmites*. It is within Deal Island Wildlife Management Area. Dames Quarter Marsh also supports a reference community of *Spartina patens/Distichlis spicata*
(saltmeadow cordgrass/saltgrass) found in high brackish marshes. St. Peter's Creek supports a tidal shrub wetland reference community of I. frutescens/S. patens. The community is found in mesohaline waters, with daily to irregular tidal inundation, and variable microtopography that may include hummocks or nearly flat areas.

The DNR WRAS characterization identified many potential restoration sites containing hydric soils and agriculture in areas of poor riparian buffer. Some of these areas are in close proximity to wetlands. There are also numerous wetland restoration opportunities on DNR Chesapeake Forest Land. Currently protected lands may provide restoration opportunities by providing sites for restoration, enhancement, or protecting adjacent properties. Oyster restoration may be another restoration opportunity.

Nontidal Wetlands of Special State Concern include:

- *Dublin Swamp*: This is a densely forested wetland and recently logged (1985) wetland. State-threatened plant species are located in the fairly open area of the logged wetland. The canopy openings in the logged section creates open wetland similar to those created historically by fire and beaver. This forested wetland is protected by the Wellington Wildlife Management Area and DNR-owned

Chesapeake Forest Land, while the recently logged section is privately owned (DNR, 1991). Dublin Swamp contains rare fish or mussel species (Shanks, 2001).

- *Princess Anne Marshes*: This linear wetland system is located along the mouths of the Loretto Branch, Manokin Branch, Taylors Branch, and Jones Creek. This wetland is not currently protected and seems especially vulnerable considering it runs through Princess Anne.
- *Potential WSSC*. This site is located just north of Princess Anne and is protect4ed by DNR-owned Chesapeake Forest Land.

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.
- Restore "gaps" in the Green Infrastructure back to natural vegetation, especially along waterways.
- Restore/create wetlands in the Manokin River watershed designed to remove nitrogen and BOD from the water.
- Restore/create wetlands within the Manokin River and St. Peters Creek watersheds designed to remove fecal coliform from the water.

Specific preservation recommendations:

- Protect wetlands and streams within the headwaters.
- Protect areas within the Green Infrastructure network that are unprotected, especially around the waterways and the large GI hubs around the southern mouth of the Manokin River and in the eastern section of the watershed.
- Protect DNR-designated Ecologically Significant Areas containing wetlands that are unprotected, including:
    - Federally-listed species at the intersection of Anderson Road and Clarence Barnes Road.
    - State-listed species along Kings Creek, south of Princess Anne.
    - Federally-listed species extending upstream beyond the Princess Anne Marshes.
    - Additional sites of concern to DNR (but with no official listing), within the waters of the Manokin River mouth.
- Preserve WSSC and their buffers.
- Protect tidal wetlands used as reference sites in DNR's study of wetland vegetative communities (Harrison and Stango, 2003).

<u>Lower Wicomico River (02130301)</u>

Background

The Somerset County portion of this watershed has 3,708 land acres (based on MDP 2002 land use GIS data). Land use is divided between forest (32%), agriculture (30%), wetlands (23%), and developed land (14%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR.

Wetlands are located mainly along the Wicomico River and along Stone Creek. Other wetlands are not directly associated with a waterway. These wetlands likely provide the functions of water quality improvement, flood attenuation, shoreline stabilization, and wildlife habitat. Hydric soil suggests where wetlands are currently or were historically. Areas having hydric soil, but that are no longer wetlands, have the potential to be good wetland restoration sites. Within the Somerset County portion of this watershed, roughly half of the soil is classified as hydric, with some areas not currently wetland (based on GIS data: NRCS SSURGO, DNR wetlands, NWI wetlands). Most soils are "poorly drained," but there are also areas of "very poorly drained."

This waterway is roughly 18.8 miles from Ellis Bay and Monie Bay to the headwaters (MDE, 2001). Portions of this watershed are also in Wicomico County, MD and Sussex County, Delaware. It drains to Tangier Sound and then to the Chesapeake Bay. The area between Whitehaven and Fruitland/Salisbury is developing rapidly, which will continue to impact the river.

Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Estuarine
    - Emergent: 6,343 acres
    - Scrub shrub: 98 acres
    - Forested: 394 acres
    - Unconsolidated shore: 32 acres
- Palustrine
    - Emergent: 1,011 acres
    - Scrub shrub: 988 acres
    - Forested: 9,041 acres
    - Unconsolidated bottom: 299 acres
    - Farmed: 195 acres
- Riverine emergent: 162 acres
- Total: 18,563 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight gain in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130301	-5.24	6.97	0	1.57	3.29

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. All estuarine portions (except Wicomico River and tributaries above ferry crossing at White Haven) are designated Use II, shellfish harvesting.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. Since it is a "Priority" Category 1 watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. It is also classified as a Category 3, a watershed in need of protection. Failing indicators include high nutrient concentrations, high nitrogen and phosphorus loads, low SAV abundance, low SAV habitat index, high amount of historic wetland loss (42,358 acres), high soil erodibility (0.29), and being on the 303(d) List for water quality impairment. Indicators for Category 3 include five migratory fish spawning areas and a high amount of wetland-dependent species.

According to the 2002 Maryland Section 305(b) Water Quality Report, tidal sections of the Lower Wicomico River and tributaries (below Johnson Pond) fail to fully support all designated uses due to low oxygen and elevated levels of bacteria from sources of non-point and natural eutrophication. Nontidal wadeable tributaries had some portions (Walston Branch subwatershed; DNR, 2000) that failed to fully support all designated uses (33.0 $mi.^2$ failed to support, 4.2 $mi.^2$ had inconclusive results) due to a poor biological community from siltation by changes in habitat and hydrology. Coulbourn Pond, Mitchell Pond #2, Mitchell Pond #3, Schumaker Pond, and Tony Tank Pond fully supported all uses. Tony Tank Lake failed to support all designated uses due to nutrients and siltation from sources of agriculture, nonpoint, upstream, and natural.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Lower Wicomico River* (tidal); fecal coliform, suspended sediments. A TMDL was completed for nutrients.
- *Tony Tank Lake*; A TMDL was completed for nutrients and sediments.
- *Walston Branch* (021303010560 non-tidal in Wicomico County); sedimentation.
- *Beaverdam Creek* (021303010562 non-tidal in Wicomico County); poor biological community.
- *Morris Pond* (021303010558 non-tidal in Wicomico County); poor biological community.
- *White Marsh Creek* (021303010558 non-tidal in Wicomico County); poor biological community.
- *Perdue Creek* (021303010562 non-tidal in Wicomico County); poor biological community.
- *South Prong Wicomico River* (021303010561 non-tidal in Wicomico County); poor biological community.

The following information is summarized from the 2001 MDE document entitled *Total Maximum Daily Loads of Nitrogen, Phosphorus, and Biochemical Oxygen Demand for the Lower Wicomico River, Wicomico County and Somerset County, Maryland*. This

TMDL was conducted for the three 8-digit watersheds, Lower Wicomico (02130301), Wicomico River Head (02130303), and Wicomico Creek (02130304), since Wicomico River Head and Wicomico Creek flow into the Lower Wicomico. The following information refers to these three watersheds. The Lower Wicomico River above Whitehaven is designated Use I, while the section below Whitehaven is Use II. These waterways do not support these uses because dissolved oxygen occasionally drops below 5.0ug/l and water quality is not adequate to maintain recreation due to high chlorophyll a (and algal blooms) inhibiting fishing and swimming. Sources of nutrients include: nitrogen – agriculture (32%), urban (32%), forest/herbaceous (23%), point sources (10%), and atmospheric deposition (3%); phosphorus – agriculture (51%), urban (21%), forest/herbaceous (14%), point sources (11%), and atmospheric deposition (3%). Point sources are mainly in the headwaters and include Salisbury WWTP and Fruitland WWTP. Other point sources are located above Johnson Pond (including Delmar WWTP). Although they are directly addressed in the Johnson Pond TMDL, they are modeled in the current TMDL as background upstream nutrients. Water samples (from the mouth of the Lower Wicomico River to Johnson Pond and to the mouth of Wicomico Creek) show water quality impairment in the upstream sections of Lower Wicomico River. High levels of chlorophyll a and low dissolved oxygen were found in sections >6 miles upstream and highest dissolved inorganic nitrogen was found in sections >8 miles upstream. The TMDL requires a 40% reduction in controllable nonpoint source for total nitrogen and total phosphorus during low flow conditions for some of the subwatersheds, including Johnson Pond and Tony Tank Lake basins.

Restoration/Preservation

This watershed has designated Green Infrastructure hub along the Wicomico River, with few areas being protected except by small Maryland Environmental Trust holdings and DNR-owned Chesapeake Forest land. These areas should be high priority for protection. The Maryland Greenways Commission proposed that the Tangier Sound Greenway be extended into this area.

There are no Nontidal Wetlands of Special State Concern in the Somerset portion of this watershed.

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.
- Restore “gaps” in the Green Infrastructure back to natural vegetation.
- Restore/create wetlands designed to reduce nitrogen and phosphorus in the subwatersheds addressed in the TMDL, including Johnson Pond and Tony Tank Lake basins.

Specific preservation recommendations:

- Protect wetlands and streams within the headwaters.
- Protect areas within the Green Infrastructure network that are unprotected, especially along the Wicomico River.

- Protect DNR-designated Ecologically Significant Areas containing wetlands that are unprotected, including: Federally-listed species and site of concern to DNR (but with no official listing), near the mouth of Stone Creek.

Monie Bay (02130302)

Background

This watershed has approximately 21,463 land acres (based on MDP 2002 land use GIS data). Land use is split between agriculture (21%), forest (43%), and wetlands (33%), with a small amount being developed land (4%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR.

There are some large wetland areas around Monie Bay, Monie Creek, and Little Monie Creek. There are other large and small wetlands throughout this watershed that are not directly associated with a waterway. These wetlands likely provide the functions of water quality improvement, flood attenuation, stream recharge, shoreline stabilization, and wildlife habitat. Hydric soil suggests where wetlands are currently or were historically. Areas having hydric soil, but that are no longer wetlands, have the potential to be good wetland restoration sites. Within this watershed, over half of the soil is classified as hydric, with a large amount of this being wetlands (based on GIS data: NRCS SSURGO, DNR wetlands, NWI wetlands). There are still some areas with hydric soils that are not wetlands, and have the potential to be restored. Most soils are "poorly drained," but there are also areas of "very poorly drained."

Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Estuarine
    - Emergent: 6,186 acres
    - Scrub shrub: 90 acres
    - Forested: 348 acres
    - RF: 91 acres
    - Unconsolidated shore: 14 acres
- Palustrine
    - Emergent: 481 acres
    - Scrub shrub: 927 acres
    - Forested: 5,438 acres
    - Unconsolidated bottom: 17 acres
    - Farmed: 27 acres
- Total: 13,619 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight loss in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130302	-0.11	0	0	0	-0.11

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. All estuarine portions (except Monie Creek) are designated Use II, shellfish harvesting.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. It is also classified as a Category 3, a watershed in need of protection. Failing indicators include a low SAV abundance, poor SAV habitat index, and being on the 303(d) List for water quality impairment. Indicators for Category 3 include a migratory fish spawning area and a high amount of wetland-dependent species.

According to the 2002 Maryland Section 305(b) Water Quality Report, a small portion of the tidal sections of Monie Bay and tributaries fail to fully support all designated uses (0.6 $mi.^2$ fails to support, 3.8 $mi.^2$ inconclusive) due to elevated levels of bacteria from sources of non-point and natural. Water quality results for nontidal wadeable tributaries were inconclusive.

There are no waterways within this watershed on the 2004 303(d) List.

A Draft Water Quality Analysis was completed for fecal coliform in Monie Bay. This study found that designated uses related to fecal coliform were being met.

The single MBSS site in this watershed had a BIBI of very poor.

Restoration/Preservation

Most of this watershed is designated as Green Infrastructure hub, with large portions being protected by DNR-owned Deal Island WMA and Chesapeake Forest land. There is still extensive unprotected land around Monie Bay, Monie Creek, and Little Monie Creek. The Maryland Greenways Commission designated this area as part of the Tangier Sound Greenway.

Deal Island WMA contains the Chesapeake Bay National Estuarine Research Reserve System site (NERRS) known as Monie Bay. The site was designated as a representative area of the lower middle area of Chesapeake Bay and contains a mixture of wetland types and upland habitats. The site is used extensively for research on nutrient uptake by wetlands (NERRS, 2004).

There are no State-designated Nontidal Wetlands of Special State Concern within this watershed, but there is a potential WSSC located near the intersection of Black Road and Pine Pole Road. This site is protected by DNR-owned Chesapeake Forest Land.

A forested tidal wetland community of *Pinus taeda/Morella cerifera/S. patens* (Loblolly pine/Wax Myrtle/Saltmeadow cordgrass) is present. This is another mesohaline system that is usually flooded less than once daily (Harrison et al., 2004).

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.
- Restore "gaps" in the Green Infrastructure back to natural vegetation, especially along waterways.

Specific preservation recommendations:

- Protect wetlands and streams within the headwaters.
- Protect areas within the Green Infrastructure network that are unprotected, especially around Monie Bay and other waterways.
- Protect DNR-designated Ecologically Significant Areas containing wetlands that are unprotected, including:
    - Federally-listed species at the mouth of Long Creek.
    - Species or community of concern to DNR (with no official status) at the headwaters of Monie Creek.
    - Federally-listed species near Harper Creek.
- Protect tidal wetlands used as reference sites in DNR's study of wetland vegetative communities (Harrison and Stango, 2003).

Wicomico Creek (02130303)

Background

The Somerset County portion of this watershed has roughly 11,710 land acres (based on MDP 2002 land use GIS data). About half of the land use is forest (51%), agriculture is the next most common (39%), and there are small amounts of developed land (7%) and wetland (3%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR.

Wetlands are scattered throughout this watershed. Some are concentrated around Wicomico Creek, Somerset Creek, and Passerdyke. Other wetlands are not directly associated with waterways. These wetlands likely provide the functions of water quality improvement, flood attenuation, stream recharge, and wildlife habitat. Hydric soil suggests where wetlands are currently or were historically. Areas having hydric soil, but that are no longer wetlands, have the potential to be good wetland restoration sites. Within the Somerset County portion of this watershed, over half of the soil is classified as hydric. While there are many wetlands within this watershed, there are still many hydric soils that are not in wetlands (based on GIS data: NRCS SSURGO, DNR wetlands, NWI

wetlands). Most soils are "poorly drained," but there are also areas of "very poorly drained," especially in the eastern portion.

Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Estuarine
  - Emergent: 584 acres
  - Scrub shrub: 22 acres
- Palustrine
  - Emergent: 488 acres
  - Scrub shrub: 268 acres
  - Forested: 1,999 acres
  - Unconsolidated bottom: 72 acres
  - Farmed: 95 acres
- Total: 3,528 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight loss in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130303	-0.15	0	0	0	-0.15

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. This watershed is designated Use I, recreation contact and protection of aquatic life.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. It is also classified as a Category 3, a watershed in need of protection. Failing indicators include a high amount of historic wetland loss (16,422 acres), a high soil erodibility (0.31), and being on the 303(d) List for water quality impairment. Indicators for Category 3 include a high imperiled aquatic species indicator, four migratory fish spawning areas, and a high percent of the watershed forested (55%).

According to the 2002 Maryland Section 305(b) Water Quality Report, water quality results for the tidal sections of Wicomico Creek and tributaries were inconclusive. The nontidal wadeable tributaries had some portions (Passerdyke Creek sub-watershed; DNR, 2000) that failed to fully support all designated uses (6.0 $mi.^2$ failed to support, 2.7 $mi.^2$ had inconclusive results) due to a poor biological community from siltation by changes in habitat and hydrology. Allen Pond fully supports all uses.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Wicomico Creek* (tidal); suspended sediments. A TMDL was completed for nutrients.
- *Passerdyke Creek* (021303030565 non-tidal); sedimentation.

The following information is based on a 2000 MDE document entitled *Total Maximum Daily Loads of Nitrogen and Phosphorus for the Wicomico Creek Wicomico and Somerset County, Maryland*. Allen Pond drains to Wicomico Creek which drains into Wicomico River. This Creek has a high amount of sedimentation due to the limited amount of tidal flushing. Beef cattle and poultry operations are present in the upper reaches and poultry waste is applied to row crops throughout the watershed. Agricultural drainage ditches are also common in the upper reaches. Violations of the Use I classification include occasional low dissolved oxygen in the upper and lower reaches, and elevated chlorophyll a in the upper reaches. Nutrients are from the following sources: nitrogen – agriculture (57%), forest/herbaceous (26%), urban (14%), atmospheric deposition (3%); phosphorus – agriculture (80%), forest/herbaceous (9%), urban (8%), atmospheric deposition (3%). Water quality sampling found the highest chlorophyll a in the center of the creek. Dissolved oxygen was below 5.0mg/l at the mouth and in the pond. The TMDL requires a 30% reduction in low flow controllable nonpoint nitrogen and phosphorus in some subwatersheds. It also requires a 35% or 55% reduction in average annual controllable nonpoint nitrogen and phosphorus, depending on the subwatershed.

MBSS found BIBI ranging from fair to very poor and FIBI of good and poor.

Restoration/Preservation

A large portion of this watershed is designated Green Infrastructure, mainly being fragmented by roads. A relatively small amount of this area is protected by METs and DNR-owned Chesapeake Forest land.

There is one State-designated Nontidal Wetland of Special State Concern and two potential WSSC in the Somerset County portion of this watershed.

- *Eden Swamp and Powerline*. This site is located near the intersection of Highway 13 and Peggy Neck Road. It contains an emergent marsh and swamp forest with several RTE plant species. The marsh contains three State-Endangered plant species and one State-Threatened plant species. Natural canopy gaps in the adjacent swamp contain another State-Endangered plant species and a RTE plant also found in the marsh. The emergent marsh is located within a powerline right-of-way. Nontidal emergent marsh, while once much more common, are now rare on the Eastern Shore due to ditching and draining for agriculture and development (DNR, 1991). Right-of-way maintenance has created canopy openings needed to maintain this emergent marsh and the rare species. Main threats include draining or ditching of the wetlands or surrounding land and woody plant succession.

Maintenance of the right-of-way should consider the needs of the rare species (Ludwig et al., 1987). It is currently unprotected.
- *Potential WSSC*. There are two unprotected WSSC both located near Somerset Park.

Specific restoration recommendations:
- Restore wetlands and streams within the headwaters.
- Restore "gaps" in the Green Infrastructure back to natural vegetation, especially along waterways.
- Restore/create wetlands, designed to remove nitrogen and BOD from the water, in subwatersheds identified in the TMDL as requiring reductions in nitrogen and phosphorus.

Specific preservation recommendations:
- Protect wetlands and streams within the headwaters.
- Protect areas within the Green Infrastructure network that are unprotected, especially around the waterways and the larger GI hubs.
- Protect DNR-designated Ecologically Significant Areas containing wetlands that are unprotected, including:
    - State-listed species along Wicomico Creek.
    - State-listed species around the Heritage Estates DNR-owned Chesapeake Forest Land.
- Preserve WSSC and their buffers.

<u>Lower Chesapeake Bay (02139998)</u>

Background

The Somerset County portion of this watershed has roughly 9,472 land acres, with the majority of the land use being wetlands (95%) and small amounts of forest and developed land (based on MDP 2002 land use GIS data). Note that wetland acreage estimates based on this land use data may not be extremely accurate. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR.

Estimates of wetland acreage for the entire Maryland portion of the watershed, based on DNR mapped wetlands, are as follows:
- Estuarine
    - Emergent: 13,362 acres
    - Scrub shrub: 9 acres
    - Unconsolidated shore: 408 acres
- Palustrine
    - Scrub shrub: 17 acres
    - Forested: 6 acres
    - Unconsolidated bottom: 7 acres
    - Unconsolidated shore: <1 acres
- Total: 13,809 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. For the time period of January 1, 1991 through December 31, 2004, there has been no regulated activity in this watershed (Walbeck, 2005).

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. All tidal waters within this watershed are designated Use II, shellfish harvesting.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as a Category 2 watershed, meeting clean water or natural resource goals.

According to the 2002 Maryland Section 305(b) Water Quality Report, portion of the Lower Chesapeake Bay (VA line to the Bay bridge) fails to fully support all designated uses (53.3 $mi.^2$ fully supports, 726 $mi.^2$ fails to supports) due to low oxygen, elevated levels of bacteria, and poor biological communities from sources of non-point and natural eutrophication and deep water.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Lower Chesapeake Bay* (tidal); nutrients, poor biological community.

Restoration/Preservation

This entire watershed is designated Green Infrastructure hub. All is protected (Martin National Wildlife Refuge and DNR-owned South Marsh Island WMA) except the southern portion of Smith Island. The Maryland Greenways Commission designated this area as part of the Tangier Sound Greenway.

There is no State-designated Nontidal Wetlands of Special State Concern within the Somerset County portion of this watershed.

Virtually all of the land is designated as Ecologically Significant land due to it having State-listed species. An area inland of Fog Point Cove is also federally-listed.

Specific preservation recommendations:

- Protect areas within the Green Infrastructure network that are unprotected (on the southern portion of Smith Island).