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Background

The following information is based on the 2004 Calvert County Comprehensive Plan. This County has 101 miles of shoreline. In 2000, there were 74,563 people in the County. The 2020 population projection is 96,000 people. One land use objective is to preserve the County's rural character, including prime farmland, contiguous forest, historic resources, and environmentally sensitive area. Forest covers over half of the County, with 37% of this being forest interior. The main mineral resources are sand and gravel, located mainly in the interior portion of the County, with some on the lowland terraces along the Patuxent River. There is a lot of development sprawl in this County.

Based on MDP 2002 GIS land use data, Calvert County has 83,868 acres of open water and 137,109 acres of land. The land acres are divided as follows: urban 36,818 acres

(27%), agriculture 27,721 acres (20%), forest 69,501 acres (51%), wetlands 3,013 acres (2%) and barren land 55 acres (<1%).

Soil classified as prime farmland (based on MDP Natural Soil Groups GIS data) is scattered throughout the County, with highest amounts along the Patuxent River. In order to preserve agriculture in the County, wetland restoration/creation should attempt to avoid areas classified as prime farmland.

There are two State-designated 6-digit watersheds and three 8-digit watersheds in this County: Patuxent River (021311) including Patuxent River Middle (02131102) and Patuxent River Lower (02131101), West Chesapeake Bay (021310) including the 8-digit watershed West Chesapeake Bay (02131005).

Streams

The Maryland Tributary Strategies document *Patuxent River Basin Summary Final Version for 1985-2002 Data: January 29, 2004* describes the Patuxent River Watershed (an area containing parts of St. Mary's, Anne Arundel, Prince George's, Calvert, Charles, Howard and Montgomery). As of 1998, some BMP goals for this basin have been met (marine pumpouts, shore erosion, septic connections, and stormwater management retrofits) but some have not been met (controlling erosion and sediment, urban nutrients, septic pumping, enhanced stormwater management, forest practices). The Patuxent River receives water from the Little Patuxent, Middle Patuxent and Patuxent. This watershed has over 100 species of fish. Land use for the entire basin is dominated by forest (44%), followed by urban (30%), and agriculture (26%). About 70% of the houses are on municipal sewage and 81% are on public water. In 2002, the main nitrogen, phosphorus, and sediment sources within the Upper Potomac River basin were point sources (34%, 30%, 0%, respectively), urban (32%, 36%, 28%, respectively), and agriculture (21%, 22%, and 55%, respectively). Tributary stations had total nitrogen levels mostly ranked as good and levels were generally improving since 1985. The two sites ranked poor were located at the northern portion (MD Route 97 and MD Route 4). Total phosphorus, total suspended solids, and algae were ranked poor to good, with most stations improving for phosphorus but not as much for the other parameters. Stations ranked poor were located in the middle portion of the river. Of the three sites sampled for SAV abundance, two (the upper and middle portion of the river) exceeded SAV goals during the period between 1984 and 2002.

The Maryland Tributary Strategies document *Maryland Lower Western Shore Final Version for 1985-2002 Data: February 2, 2004* describes the success of BMPs in the Lower Western Shore Watershed (an area containing parts of Anne Arundel and Calvert Counties) like this:

> BMP implementation for structural shore erosion control, marine pumpout installation, septic connections and denitrification, and nutrient management plans are all making good progress toward Tributary Strategy goals. For other issues, such as stormwater and urban runoff management,

forest conservation, forested and grassed buffers, and stream protection, progress has been slower and in some cases, non-existent.

Surface water is generally slow-moving due to the low elevations in the basin. Land use for the entire basin is largely forest (46%) and urban (40%), followed by agriculture (14%). Roughly 62% of the houses are on municipal sewage and 59% are on public water. The main nitrogen, phosphorus, and sediment sources within the Lower Western Shore basin were urban (40%, 63%, and 27%, respectively), point sources (40%, 20% and 0%, respectively) and agriculture (9%, 7%, and 59%, respectively). Tributary stations sampled had total nitrogen ranked fair. Levels had improved at most station during the period 1985-2002. Total phosphorus was mostly ranked fair, with all stations improving during the period 1985-2002. Total suspended solids were ranked fair to good. Abundance of algae was generally ranked as poor. Dissolved oxygen was ranked as poor to fair, with poor sites being located in the northern portion of the basin (Magothy, Severn, and South Rivers). Of the five sites sampled for SAV abundance between 1984 and 2002, only one site exceeded SAV goals during portions of that period (Severn River Mesohaline). In 1995-2000, benthic communities were better at South and West Rivers than at Severn and Magothy Rivers.

This County does not contain much livestock, and the majority of those are fenced out of the waterway.

Wetlands

Wetland Classifications

According to Tiner and Burke (1995), in 1981-1982 there were 10,707 acres of wetlands (1.8% of the State's total). The wetland types were palustrine (7,077 acres) and estuarine (3,630 acres). Comparisons of this 1981-1982 wetland acreage with historic wetland acreage (based on hydric soils) represent a 25%, or 3,563 acre loss (MDE, 2002a). A 1994 U.S. Fish and Wildlife Service report investigated status and trends of wetlands for the period from 1981-92 to 1988-89. Approximately 74 acres of vegetated wetlands were converted to uplands, changed to a nonvegetated wetland, or became a deepwater habitat. Wetland conversion to uplands was due to creation of new agricultural land, road or highway construction, or construction of recreational facilities. There were over 130 acres of forested wetlands that were altered and became another wetland type, most predominantly open water ponds, or had increases or decreases in hydrology.

Nontidal wetland hydrology is supported by groundwater discharge, overbank flooding, or a combination of both sources. Nontidal wetlands are primarily forested and found along stream corridors. In some areas, increases in surface runoff has resulted in the downcutting of stream channels, resulting in less frequent overbank flooding and less water to the wetland.

Tidal wetland acreage was also estimated in *The Coastal Wetlands of Maryland* (Table 1). Calvert County had 2,662 acres of vegetated tidally-influenced wetlands (excluding SAV). A large amount of vegetated wetland is brackish high and low marsh. There is also

a moderate amount of fresh marsh and smaller amounts of shrub swamp. 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.

Table 1. Tidal wetland acreage within Calvert 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	6
	Red maple/Ash	18
Swamp forest *(fresh except pine, which is often brackish)*	Bald cypress	0
	Red maple/Ash	0
	Loblolly pine	0
Fresh marsh	Smartweed/Rice cutgrass	25
	Spatterdock	6
	Pickerelweed/Arrow arum	79
	Sweetflag	0
	Cattail	195
	Rosemallow	11
	Wildrice	28
	Bulrush	4
	Big cordgrass	14
	Common reed	66
Brackish High Marsh	Meadow cordgrass/Spikegrass	303
	Marshelder/Groundselbush	190
	Needlerush	2
	Cattail	664
	Rosemallow	7
	Switchgrass	10
	Threesquare	220
	Big cordgrass	447
	Common reed	36
Brackish Low Marsh	Smooth cordgrass	331
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	0

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

- Estuarine wetland 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.
    - 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).

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

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:

a. A decrease in the volume and velocity of flowing water.
   Value: Helps prevent stream channel and shoreline erosion, and habitat destruction.
b. Deposition and retention of fine sediment.

Value: Helps maintain water quality and aquatic ecosystems.

c. 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.

The topography in most of the West Chesapeake Bay sub-basin rises sharply adjacent to streams, resulting in a relatively narrow floodplain. The width of the floodplain greatly influences the amount of water that can be temporarily stored or slowed, so the flood attenuation function has probably moderate to low benefits. Most structures are located beyond the edge of the ravines bordering the wetlands.

Storm surge protection is probably performed less effectively by wetlands in Calvert County than at sites with broader expanses of tidal wetlands.

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).

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.

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.

Nontidal Wetlands of Special State Concern

There are several State-designated Nontidal Wetlands of Special State Concern, mostly located in the southern portion of the County. These are described in the section for the individual watersheds.

Wetland Restoration Considerations

Hydric soils suggest where wetlands are currently or were historically. There are some hydric soils that are not mapped wetlands (based on MDP Natural Soil Groups GIS data

and NWI/DNR wetlands). These are mostly located along waterways, including some large sections along the Patuxent River and in the headwaters throughout. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration.

Calvert County has hired the local Soil Conservation District (SCD) to conduct a detailed survey identifying potential sites for wetland mitigation in the County. Since the eastern portion of the County generally has topography that is less conducive to wetland restoration, including steep slopes along the streams, the SCD is focusing on the west side of the County (largely in the Patuxent River watershed). Results from this study will be the property of the Department of Public Works, and will be used to meet their mitigation requirements.

Wetland preservation is a high priority throughout the County. As mentioned previously, it is extremely difficult to find sites for wetland restoration on the eastern portion of the County. It is even difficult to find land for reforestation, since most areas are either actively farmed or protected forest. For this reason, on the eastern portion of the County, it may be necessary to do out-of-kind restoration.

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

There were numerous sourcewater assessments (SWA) completed for this County. A SWA for 36 community water systems withdrawing from the confined aquifer found they were susceptible to naturally occurring arsenic and radon (depending on the approved maximum contaminant level). They were not susceptible to pollutants originating from the land surface. Information on SWAs completed for smaller areas is located within that watershed section.

The following information is based on the 2004 Calvert County Comprehensive Plan. The County withdraws its potable water from four major confined aquifers (the Piney Point, Nanjemoy, Aquia, and Magothy). This County has one of the highest percentage of sewage entering septic systems in the State, estimated to contribute 25% of nonpoint sources. Fisheries resources have been reduced since the early 1900s due to degraded water quality, over-fishing, and poor fisheries management. Since water quality and fisheries management has been improving in more recent times, the fisheries industry should also improve. Some of the natural resources and sensitive areas objectives include:

- Protect wetlands, floodplains, wetland and waterway buffers, and steep slopes
- Restore or create wetlands in disturbed areas
- Establish forested wetland buffers
- Protect existing habitat and RTE species (including Puritan tiger beetle populations in Calvert Cliffs)
- Protect systems for nutrient removal and flood control
- Maintain vegetation in floodplains
- Protect stream valleys and greenways
- Establish buffers around perennial and intermittent streams
- Coordinate community and watershed planning
- Educate
- Restore lost systems
- Reduce 1985 nutrient levels entering the Chesapeake Bay by 40% by the year 2008
- Use groundwater, surface water, forests, and fisheries in sustainable manner
- Conserve water

- Develop watershed management plans for the major tributaries
- Provide public access to the Patuxent River and Chesapeake Bay

Watershed management plans have been completed for Parkers Creek and Hunting Creek. The County is working on a plan to reduce nutrients in Mill Creek, but this plan does not focus on wetlands. A plan was completed in 1990 to identify wetland mitigation on the eastern side of the County. All seven identified wetlands from this study have since been built.

Other Relevant Programs

Green Infrastructure
Green Infrastructure hubs and corridors cover a large portion of the County. 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.

Ecologically Significant Areas
DNR designates areas that contain habitat for rare, threatened and endangered species and rare natural community types. These areas are buffered to create the "sensitive species project review areas" GIS layer, intented to assist in assessing environmental impacts and reviewing potential development changes. This layer generally includes designated Natural Heritage Areas, Wetlands of Special State Concern, Colonial Waterbird Colonies, and Habitat Protection Areas.

Natural Heritage Areas
There are a few State-designated Natural Heritage Areas (NHA) located in the West Chesapeake Bay watershed. These areas 1) Contain species considered to be threatened, endangered, or in need of conservation; 2) Have unique geology, hydrology, climate or biology; and 3) Are among the best Statewide examples.

Rural Legacy
Designated Rural Legacy land is located in the southern half of the County (in watersheds Patuxent River lower and West Chesapeake Bay). For detailed information about the program, refer to those individual watershed sections.

Priority Funding Areas
Priority Funding Areas (PFAs) are scattered throughout the County, with the largest one in the very southern tip of the County. The majority of other ones are located on the Chesapeake Bay (e.g. Chesapeake Beach, Calvert Cliffs) or along Rte. 2/4 (e.g. Prince Frederick). Due largely to the limited transportation corridors in the County, the County is very strict with zoning, and rezoning is quite difficult.

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.

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

Patuxent River Middle (02131102)

Background

MDE is basing its calculations on the most recent DNR 8-digit watershed delineation, having different borders for this watershed than the previous version. The watershed covers 66,478 acres (DNR & MDE, 2000) and is located in Anne Arundel, Prince George's, and Calvert Counties. Based on MDP 2002 GIS land use data, the Calvert County portion of the Patuxent River middle watershed has 292 acres of open water and 5,009 acres of land. The land acres are divided as follows: urban 1,919 acres (38%), agriculture 1,116 acres (22%), forest 1,781 acres (36%), and wetlands 194 acres (4%). Since MDP estimates of wetland acreage are often underestimated, better estimates, based on DNR wetland data, are present later in this document.

Fresh tidal marsh is located along meandering portions of the Patuxent River. It likely took hundreds or thousands of years to create these wetlands. The tidal portion extends from Queen Anne's Bridge in Anne Arundel County to the discharge into the Chesapeake Bay, roughly forty-five miles. The freshwater tidal marsh section runs from Ferry Landing (in Calvert) to Waysons Corner (in Anne Arundel). Between Ferry Point and

Cocktown Creek, there is a transition zone with fresh and brackish. South of Cocktown Creek is brackish marsh. It is believed that the Patuxent River was historically wider and deeper, but due to agricultural sedimentation in the 18th and 19th centuries, this open water converted into low marsh and eventually high marsh. It is also believed that common reed has been spreading along the Patuxent River, near Mataponi Creek, due to the heavy sedimentation occurring there. The common reed in the freshwater tidal marshes has replaced the once prevalent stands of wildrice. As of the early 1980s, wildrice was still abundant around Ferry Point and between a mile below MD Rte. 4 and the southern end of Jug Bay (Sipple, 1999).

The Patuxent River was designated as a scenic river by the Maryland General Assembly. The following is a summary from a document titled *Patuxent River Policy plan: An update for 1984 to 1997* (DNR, 1997). The Patuxent River Commission supports, coordinates, and implements programs, policies, and projects of the Patuxent River. Among the managements plans proposed for the Patuxent River include:

- Establishment of "a primary management area" delineating the area along the river and its tributaries to identify and manage land from which pollution is most likely to be transported into the river.
    - Prince George's County- has established the Patuxent River Management Area, with criteria for stream and wetland buffers within Patuxent watershed
    - Montgomery County- has adopted a master plan for Patuxent River, with guidelines for the protection of steep slopes, wetlands, reservoirs, and other sensitive areas in the Patuxent River watershed.
- Implementation of a comprehensive watershed management approach to control all sources of pollution and resource degradation.
- Continued restoration, improvement, and protection the habitat functions of aquatic and terrestrial living resources. These include:
    - Riparian forest- to stabilize stream banks.
    - Stream quality- to improve spawning ranges.
    - Wetlands-protection and restoration.
    - Forest land- to enhance contiguous tracts of forest.
    - Submerged aquatic vegetation and tidal marsh.
    - Concentrating new development in and around existing developed areas and population centers while protecting the rural and agricultural landscape.
    - Enhancing the environmental quality and community design in new and existing communities.
    - Developing a sense of stewardship for the Patuxent River and its watershed through increased public education and participation programs.
    - Funding to support and meet the above plans.

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

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

- Estuarine
  - Emergent: 1,225 acres
  - Scrub shrub: 13 acres
  - Unconsolidated shore: 17 acres
- Palustrine
  - Aquatic bed: 12 acres
  - Emergent: 343 acres
  - Scrub shrub: 347 acres
  - Forested: 2,400 acres
  - Unconsolidated bottom: 274 acres
  - Unconsolidated shore: 18 acre
  - Farmed: 10 acres
- Total: 4,658 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 (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02131102	-3.11	3.77	9.00	0	9.66

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. For the Calvert County portion they are as follows:

- Use I: water contact recreation and aquatic life; all portions except those described below.
- Use II: shellfish harvesting; all estuarine portions of tributaries except Patuxent River and tributaries above Ferry Landing.

Water Quality

Source water assessments were completed for several water supplies within this watershed (in addition to SWAs completed for County-wide water supplies). The water supply name and susceptibility are as follows:

- *St. Leonard*: naturally occurring radiological contaminants (depending on approved maximum contaminant levels).

- *Hunting Hills*: naturally occurring radiological contaminants (depending on approved maximum contaminant levels).
- *Walnut Creek and Tara Subdivision*: naturally occurring radon (depending on approved maximum contaminant levels).
- *Cross Point*: not susceptible.

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resource 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 pristine or sensitive watershed in need of protection. Failing indicators include high levels of the nutrients phosphorus and nitrogen, low SAV abundance and habitat index, poor benthic index of biological integrity (BIBI), poor instream habitat index, high population density, and high soil erodibility (0.29). Wetland loss was estimated to be 7,648 acres. Indicators for Category 3 include high imperiled aquatic species indicator, migratory fish spawning area, and high presence of wetland dependant species.

The 2002 305(b) report indicates that 0.1 square miles of the tidal mainstem and tidal tributaries meets designated uses. An additional 1.1 square miles of tidal mainstem and tributaries failed to meet all designated uses due to pesticides, low oxygen, and bacteria from natural conditions and unknown sources. In nontidal, wadeable tributaries, 44.8 miles of waters were found to meet all designated uses. Results were inconclusive for an additional 66.5 miles of nontidal, wadeable tributaries (DNR, 2002). The 2000 305(b) report noted bank stability as a site-specific habitat issue that might affect the aquatic community (DNR, 2000).

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:

- *Patuxent River middle* (tidal); nutrients, sediments, chlorpyrifos (in water and sediment).
- *Swan Point Creek* (021311020908 non-tidal in Prince Georges County); poor biological community.
- *Swan Point Creek Unnamed Tributary* (021311020908 non-tidal); poor biological community.
- *District Branch* (021311020917 non-tidal in Prince Georges County); poor biological community.
- *Ferry Branch* (021311020915 non-tidal in Anne Arundel County); poor biological community.
- *Patuxent River Unnamed Tributary* (021311020915 non-tidal); poor biological community.
- *Patuxent River Unnamed Tributary* (021311020914 non-tidal in Anne Arundel County); poor biological community.
- *Pindell Branch* (021311020908 non-tidal); poor biological community.

- *Cabin Branch* (021311020906 non-tidal in Anne Arundel County); poor biological community.
- *Deep Creek* (021311020908 non-tidal in Anne Arundel County); poor biological community.
- *Lyons Creek* (021311020910 non-tidal in Anne Arundel/Calvert Counties); poor biological community.

Multiple subbasins within this watershed are impaired by an April 7, 2000 PEPCO oil spill. Impaired areas include Craney Creek and Buena Vista. A TMDL is not required for these contaminants since other controls will results in water quality designation attainment.

The Maryland Biological Stream Survey sampled 13 sites in Anne Arundel County in 2000-2002, and seven sites in Anne Arundel, Prince George's, and Calvert County in 1995-1997. Index scores for fish and benthic communities were generally poor or fair, with marginal or sub-optimal instream habitat scores. Only two sites, Lyons Creek in Calvert County and an unnamed tributary to Mataponi Creek in Prince George's County, received scores in the "good" range for fish and benthic communities. Other sampled streams included Deep Creek, Mataponi Creek, Charles Branch an a tributary, Ferry Branch, tributaries to the Patuxent River, Pindell Branch, Cabin Branch, Swan Point Creek, and Southwest Branch. Common fish species included Blacknose dace, Rosyside dace, Eastern mudminnow, Tesselated darter, American eel, Bluegill, Least Brook lamprey, and Pumpkinseed.

During 1985-2002, the Patuxent River watershed showed improvements to water quality by reductions in total nitrogen and total phosphorus concentrations at most sample points in the mainstem of the river. During the same period, abundance of algae increased at four of twelve sample points while the remainder of sites showed no trend. The total suspended solids increased at one site during 1985-2002 at one sample point (Jackson Landing), while at thirteen other sites there was no trend or a decrease in total suspended solids. Changes to water clarity showed no trend or a decline during the same period at ten sample sites (Basin Summary Team and CBP, 2004b)

Restoration/Preservation

A Green Infrastructure hub follows Patuxent River and Lyons Creek. This hub is mostly unprotected, with the exception of Merkle NRMA. This hub and connecting corridor contain some areas that are in agriculture, locations for possible restoration. The only other protected land is a County park. There are several Green Infrastructure hubs and corridors spread throughout the watershed. Some of the larger Green Infrastructure hubs are around Patuxent River NRMA and around Battle Creek Cypress Swamp Preserve. Most of the Green Infrastructure network here is unprotected. Exceptions include Kings Landing NRMA, Hall Creek NRMA, two TNC properties, a few Maryland Environmental Trust holdings, small County-owned properties, and the U.S. Naval Testing Center. There are several areas within the Green Infrastructure hubs, currently in agriculture, where restoration to natural vegetation may be desirable (DNR, 2000-2003).

According to the Maryland Greenways Commission, there are several existing or proposed recreational greenways.

- *Battle Creek to Parker's Creek Greenway.*
- *Ferry Landing Road to Hall Creek Greenway.*
- *Patuxent Regional Greenway*: This includes existing and proposed greenways connecting southern Maryland to central Maryland.
- *Leitches Wharf Spur.*

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

Calvert County has hired the local Soil Conservation District (SCD) to conduct a detailed survey identifying potential sites for wetland mitigation in the County. As part of this survey, they are evaluating topography and soils, and conducting field visits. Desirable sites would be marginal cropland that could provide water quality benefits. The SCD wants to avoid prime farmland and are not intending to remove large farm parcels from production. Since many sites in this County are within agricultural preservation and agricultural easements, the SCD is considering these sties as well. While the land owners have not been contacted yet about potential restoration on their property, the SCD is finding many sites that fit their criteria. Results from this study will be the property of the Department of Public Works, and will be used to meet their mitigation requirements.

Sipple (1999) described the presence of the invasive plant purple loosestrife in freshwater tidal wetlands of Lyon's Creek (on the Anne Arundel/Calvert County border) in the 1980's. Sipple also reported the presence of the extirpated southern naiad (*Najas gracillima*), previously thought to be endangered extirpated, and the threatened shoreline sedge (*Carex hyalinolepis*) along Lyon's Creek. The current status of the southern naiad is unknown. *Phragmites* and wildrice were identified as dominant plants in many areas of the freshwater tidal marsh (Sipple, 1999), and there is concern that *Phragmites* is spreading.

Existing restoration recommendations:

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

Existing preservation recommendations

- Protect currently unprotected Green Infrastructure, especially around waterways.
- Protect additional wetlands within designated Ecologically Significant Areas.
- Protect wetlands and streams within the headwaters.

<u>Patuxent River Lower (02131101)</u>

Background

Other Counties within this watershed are Anne Arundel, Charles, Prince George's, and St. Mary's. Refer to the sections describing those Counties for information on the watershed in other jurisdictions.

Based on MDP 2002 GIS land use data, the Calvert County portion of the Patuxent River lower watershed has 16,363 acres of open water and 95,181 acres of land. The land acres are divided as follows: urban 24,338 acres (26%), agriculture 22,990 acres (24%), forest 45,869 acres (48%), wetlands 1,946 acres (2%) and barren land 38 acres (<1%). Since MDP estimates of wetland acreage are often underestimated, better estimates, based on DNR wetland data, are present later in this document.

Fresh tidal marsh is located along meandering portions of the Patuxent River. It likely took hundreds or thousands of years to create these wetlands. The tidal portion extends from Queen Anne's Bridge in Anne Arundel County to the discharge into the Chesapeake Bay, roughly forty-five miles. The freshwater tidal marsh section runs from Ferry Landing (in Calvert) to Waysons Corner (in Anne Arundel). Between Ferry Point and Cocktown Creek, there is a transition zone with fresh and brackish. South of Cocktown Creek is brackish marsh. It is believed that the Patuxent River was historically wider and deeper, but due to agricultural sedimentation in the 18th and 19th centuries, this open water converted into low marsh and eventually high marsh. It is also believed that common reed has been spreading along the Patuxent River, near Mataponi Creek, due to the heavy sedimentation occurring there. The common reed in the freshwater tidal marshes has replaced the once prevalent stands of wildrice. As of the early 1980s, wildrice was still abundant around Ferry Point and between a mile below MD Rte. 4 and the southern end of Jug Bay (Sipple, 1999).

The Patuxent River was designated as a scenic river by the Maryland General Assembly. The following is a summary from a document titled *Patuxent River Policy plan: An update for 1984 to 1997* (DNR, 1997). The Patuxent River Commission supports, coordinates, and implements programs, policies, and projects of the Patuxent River. Among the managements plans proposed for the Patuxent River include:

- Establishment of "a primary management area" delineating the area along the river and its tributaries to identify and manage land from which pollution is most likely to be transported into the river.
    - Prince George's County- has established the Patuxent River Management Area, with criteria for stream and wetland buffers within Patuxent watershed
    - Montgomery County- has adopted a master plan for Patuxent River, with guidelines for the protection of steep slopes, wetlands, reservoirs, and other sensitive areas in the Patuxent River watershed.
- Implementation of a comprehensive watershed management approach to control all sources of pollution and resource degradation.
- Continued restoration, improvement, and protection the habitat functions of aquatic and terrestrial living resources. These include:
    - Riparian forest- to stabilize stream banks.

  - Stream quality- to improve spawning ranges.
  - Wetlands-protection and restoration.
  - Forest land- to enhance contiguous tracts of forest.
  - Submerged aquatic vegetation and tidal marsh.
- Concentrating new development in and around existing developed areas and population centers while protecting the rural and agricultural landscape.
- Enhancing the environmental quality and community design in new and existing communities.
- Developing a sense of stewardship for the Patuxent River and its watershed through increased public education and participation programs.
- Funding to support and meet the above plans.

Impervious surface is below 2% for most of the subwatersheds (DNR, 2003a). Significant anadromous fish spawning area is located in Hall Creek, Hunting Creek, and Lyons Creek, with other spawning areas being St. Leonards Creek, Helen Creek, and Mill Creek. Hunting Creek has a very diverse fish community. This County is part of an important bird flyway. In 1992, 37% of the forest was considered forest interior dwelling species (FIDS) habitat. Estimates of future growth in the County found that FIDS habitat will drop considerably. DNR tracks sensitive species within this watershed, including three animals and nineteen plants (DNR, 2003a).

Of the soils, 38% are considered prime farmland, 3% are hydric, but not associated with a floodplain, marsh, or swamp, and 12% are wet floodplain, marsh, or swamp (DNR, 2003a).

This watershed includes (DNR, 2003a):

- Battle Creek Cypress Swamp: home to the northernmost stand of bald cypress trees
- Good spawning area for anadromous fish in Hall and Hunting Creeks
- Greater than twenty sensitive species

Drinking water supply is mostly from two confined aquifers (Piney Point-Nanjemoy aquifer and Aquia aquifer), reducing chances of contamination. However, heavy withdraws are dropping the water level in these aquifers (DNR, 2003a).

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

- Estuarine
  - Emergent: 4,372 acres
  - Scrub shrub: 89 acres
  - Forested: 10 acres
  - Unconsolidated shore: 125 acres
- Palustrine
  - Aquatic beds: 73 acres

  - Emergent: 605 acres
  - Scrub shrub: 1,040 acres
  - Forested: 7,619 acres
  - Unconsolidated bottom: 687 acres
  - Unconsolidated shore: 7 acres
  - Farmed: 79 acres
- Total: 14,707 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 (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02131101	-11.56	9.98	0	0.15	-1.43

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. For the Calvert County portion they are as follows:

- Use I: water contact recreation and aquatic life; all portions except those described below.
- Use II: shellfish harvesting; all estuarine portions of tributaries except Patuxent River and tributaries above Ferry Landing.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include low SAV abundance and habitat index, poor tidal and non-tidal benthic index of biological integrity (BIBI), poor non-tidal instream habitat index, and high amount historic wetland loss (42,599 acres). Indicators for Category 3 include high imperiled aquatic species indicator, migratory fish spawning area, high number of wetland-dependent species, high amount of headwater streams in Interior Forest, and high percent of the watershed being forested.

According to the 2002 305(b) report, a portion of the nontidal mainstem and tributaries fail to support all designated uses due to pesticides, nutrients, low oxygen, and bacteria due to nonpoint sources, failing septics, natural sources (poor tidal flushing), eutrophication, and other sources. The nontidal, wadeable tributaries do support all designated uses. Lake Lariat does not support all designated uses due to Hg in fish tissue due to atmospheric deposition and other 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:

- *Patuxent River lower* (tidal); fecal coliform, poor biological community, sediments, nutrients, chlorpyrifos (in water).
- *Mill Creek* (tidal); fecal coliform.
- *Mill Creek* (021311010884 tidal in Calvert County); fecal coliform.
- *Solomons Island Harbor* (021311010873 tidal in Calvert County); fecal coliform.
- *Harper and Parson Creeks* (021311010871 tidal in St. Mary's County); fecal coliform.
- *Goose Creek* (021311010871 tidal); fecal coliform.
- *Indian Creek* (021311010887 tidal in St. Mary's/Charles County); fecal coliform.
- *Town Creek* (021311010872 tidal in St. Mary's County); fecal coliform.
- *St. Thomas Creek* (021311010877 tidal in St. Mary's County); fecal coliform.
- *Island Creek* (021311010878 tidal in Calvert County); fecal coliform.
- *Washington Creek* (021311010884 tidal in St. Mary's County); fecal coliform.
- *Persimmons Creek* (021311010884 tidal in St. Mary's County); fecal coliform.
- *Battle Creek* (021311010879 tidal in Calvert County); fecal coliform.
- *Buzzard Island Creek* (021311010882 tidal); fecal coliform.
- *Buzzard Island Creek* (021311010882 non-tidal in Calvert County); poor biological community.
- *Summerville Creek Unnamed Tributary* (021311010894 non-tidal in Prince Georges County); poor biological community.
- *Fowler's Mill Branch* (021311010902 non-tidal in Calvert County); poor biological community.
- *Cuckold Creek* (021311010874 non-tidal in St. Mary's County); fecal coliform, poor biological community.
- *Swanson Creek* (021311010890 non-tidal in Prince Georges County); poor biological community.
- *Patuxent River Unnamed Tributary* (021311010895 non-tidal in Calvert County); poor biological community.
- *Cocktown Creek Unnamed Tributary* (021311010896 non-tidal in Calvert County); poor biological community.
- *Chew Creek* (021311010899 non-tidal in Calvert County); poor biological community.
- *Hall Creek* (021311010902 non-tidal in Anne Arundel County); poor biological community.

Multiple subbasins within this watershed are impaired by a April 7, 2000 PEPCO oil spill. Impaired areas include Swanson, Washington, Trent Hall, Persimmon, Indian, and Cremona Creeks, and Golden Beach. A TMDL is not required for these contaminants since other controls will results in water quality designation attainment.

A TMDL of mercury was completed for the Chesapeake Ranch Estates-owned Lake Lariat. This lake has a Surface Water Use Designation of Use 1P – water contact recreation, protection of aquatic life, and public water supply. However, MDE has issued

a fish consumption advisory, suggesting limits on fish consumption from this lake due to mercury. The majority of mercury is from atmospheric sources, many of which are outside of the State, so is widespread. EPA cites coal-fired electric power generators as the main culprit. In Maryland, the main sources are as follows: 43% power plants, 31% municipal waste combustors, 19% medical waste incinerators, 6% Portland cement plants, and 1% other. If existing and proposed regulatory controls for mercury emissions are imposed, this TMDL will be successfully implemented.

A TMDL has been completed for Island Creek, Town Creek, Trent Hall Creek, St. Thomas Creek, Harper, Pearson Creeks, Goose Creek and Indian Creek and a Water Quality Analysis for Battle Creek of fecal coliform in Calvert, Charles and St. Mary's Counties, Maryland. Battle Creek was not impaired by fecal coliform. There are no direct point sources of fecal coliform for the above watersheds. Nonpoint sources of fecal coliform are listed below:

Waterway	Livestock %	Pets %	Humans %	Wildlife %
Island Creek	39	19	1	40
Town Creek	0	62	4	34
Trent Hall Creek	62	13	1	25
St. Thomas Creek	24	26	2	49
Harper and Pearson Creeks	0	2	<1	98
Goose Creek	0	2	<1	98
Indian Creek	65	13	1	22

A Draft TMDL was completed for fecal coliform in restricted shellfish harvesting areas in Solomons Island Harbor (on the northeast side of the Patuxent River), Washington and Persimmon Creeks, and Cuckold Creek (all located on the southwest side of the Patuxent River) within this watershed (MDE, 2005). There are no point discharge permits for fecal coliform within these basins. Nonpoint sources of fecal coliform are listed below:

Waterway	Livestock %	Pets %	Humans %	Wildlife %
Solomons Island Harbor Basin	8	74	4	14
Washington and Persimmon Creeks Basin	48	16	1	36
Cuckold Creek Basin	56	24	1	19

Total nitrogen and total phosphorus have generally improved in the mainstem Patuxent River between 1985 and 2001, however nutrient induced algae blooms are still frequent there. Suspended sediments impair waters from below Rte. 231.

Nutrient-induced algae blooms, mahogany tides, and black tides occur in the mainstem and black tides occur within St. Leonards Creek and Battle Creek. MBSS sampling ranked sites as mostly fair to poor, with some ranked very poor. Based on the biological ranking, Lyons Creek was ranked highest and Fishing Creek and Hunting Creek were ranked lowest. The highest nitrate concentration was found at Lyons Creek and

Schoolhouse Branch. Of the eight DNR water quality stations sampled between 1998 and 2001 along the Lower Patuxent River mainstem, most had low levels of total nitrogen. The sampling points further upstream (from south of Benedict to Nottingham) generally had poorer water quality (i.e., worse total phosphorus, algae, and total suspended solids). Water quality sampling within Solomons Harbor found low bottom dissolved oxygen and higher chlorophyll a in upstream tidal waters. Potential nitrogen loads to surface water within Solomons Harbor subwatershed (the watershed with the highest amount impervious surface) are septic systems (35-50%), atmospheric deposition (10%), and other nonpoint sources (remaining amount). In Hunting Creek subwatershed, nitrogen sources were estimated to be from atmospheric (45%), nonpoint (36%), and septic systems (19%). It is predicted that nonpoint nitrogen loads will increase by 14% in build-out scenarios. Of Calvert County residents, 90% are on septic systems. MDP estimates 25% of the County's nonpoint sources nitrogen is from septic systems. Oyster bed and SAV areas are much smaller in size than they were historically. Due to high levels of fecal coliform bacteria, MDE restricts shellfish harvesting in Battle Creek, Buzzard Island Creek, Island Creek, Solomons Island Harbor, and an area within the mainstem (upstream of Gods Grace Point). MDE allows only conditional harvesting in an additional area along the mainstem, between Gods Grace Point and Buzzard Island Creek. The Chesapeake Bay Program reported that the mainstem Patuxent River, upstream of Sheridan Point, had pesticide levels high enough to potentially impact biological resources. There was insufficient data to assess toxicity of water downstream of Sheridan Point. Forty-one percent (58 miles) of the County's shoreline is eroding, with the majority eroding at a rate of 0-2 feet per year (DNR, 2003a).

The 2003 Lower Patuxent River nutrient synoptic survey focused on Hall Creek, Island Creek, and Solomons Harbor watersheds, with other samples taken outside these subwatersheds. These subwatersheds were the focus due to high development in Hall Creek, boating impacts in Island Creek, and septic issues in Solomons Harbor. Nutrient concentrations and yields were generally low compared to other watersheds in the State. Only one station had high nitrate/nitrite levels (an unnamed tributary to Patuxent at Cage Road). Four stations had excessive nitrogen yields and four had high yields. Six stations had excessive orthophosphate concentration, and five had high concentration. Many of the high orthophosphate levels were concentrated in the Hall Creek areas. Elevated nutrient levels were generally in subwatersheds of high residential development with individual septics. Index of biotic integrity was generally poor or very poor. Fish communities were also degraded. Macroinvertebrate and fish communities were not impacted by water quality, but by the poor instream habitat, including the lack of riffles, lack of large woody debris, and being dominated by shifting sand or hardpan clay. This habitat degradation may at least partially be affected by changes in stormwater associated with roads and impervious surface.

Restoration/Preservation

Kings Landing NRMA contains tidal marsh that may require controlled burns to maintain important early succession State (DNR, 1990).

Restoration opportunities are being evaluated for Solomons Harbor, within Mill Creek subwatershed, to improve water quality (Brownlee, 2005). Some of the suggested actions include septic system improvement, planting trees, and planting SAVs.

There are several Green Infrastructure hubs and corridors spread throughout the watershed. Some of the larger Green Infrastructure hubs are around Patuxent River NRMA and around Battle Creek Cypress Swamp Preserve. Most of the Green Infrastructure network here is unprotected. Exceptions include Kings Landing NRMA, Hall Creek NRMA, two TNC properties, a few MET holdings, small County-owned properties, and the U.S. Naval Testing Center. There are several areas within the Green Infrastructure hubs, currently in agriculture, where restoration to natural vegetation may be desirable (DNR, 2000-2003). According to the Maryland Greenways Commission, there are several existing or proposed recreational greenways.

- *Patuxent Regional Greenway*: This includes existing and proposed greenways connecting southern Maryland to central Maryland.
- *Chesapeake Beach Rail Trail*.

The following information is summarized from the document entitled *Rural Legacy FY 2003: Applications and State Agency Review*. There are two designated Rural Legacy areas within this watershed, Battle Creek/Parker's Creek and Southern Creeks, both sponsored by Calvert County. This County is experiencing some of the highest growth rates in the State, so there is a need to preserve this land. Battle Creek/Parkers Creek includes 9,300 acres of mostly undeveloped land south of Prince Frederick, in the watersheds Battle Creek and Parkers Creek. The intent of the Rural Legacy Program is to preserve large adjacent parcels, thereby creating a greenbelt of protected land from Patuxent River to the Chesapeake Bay. This is also intended to reduce development and preserve farmland. The area contains prime farmland, forest (including the northernmost stand of bald cypress), and a significant diverse ecosystem (including some significant wetland areas). According to this document, 74% of the designated areas have been preserved, connecting the mouths of Battle Creek and Parkers Creek. Calvert County plans to protect a total of 8,504 acres within this area. Southern Creeks Rural Legacy Area includes 11,227 acres in southern Calvert County, along St. Leonard's Creek, Island Creek, and Helen's Creek, next to the Patuxent River. This area has extensive prime farmland, forest, tidal wetlands, and recreational opportunities. The goal is to protect 7,500 acres. 40% of the total area is already protected. This Rural Legacy document provides a list of property owners within the Rural Legacy area who are interested in putting their land into an easement and the priority of acquiring these easements. Sites ranked as high priority may be potential protection sites for other programs.

A wetland watershed assessment was completed for Hunting Creek watershed (Chris Athanas, Ph.D & Associates, Inc. and Dewberry amd Davis, 1997) and is summarized as follows. A portion of Prince Frederick is located in the southeast corner and Huntington is located in the northern section. Past wetland impacts have been the result of sedimentation from agriculture and development (e.g. road construction). Other threats to the wetlands are from construction, changes in hydrology, poorly-sited stormwater basins, and fragmentation. There are five areas within this watershed where zoning

suggests higher potential for wetland impacts. These are Huntington, Prince Frederick, two Transfer Zones, and a Rural Commercial Zone. Wetland functional assessments were completed for 55 NWI-designated wetlands in these growth areas, with results mapped in the document. Approximately 91% of these wetlands were palustrine forested. The ten most valuable wetlands, based on the wetland functional assessments, were along Reits Branch, Sewell Branch (2 sites), Hunting Creek (2 sites), Fox Point Run, Unnamed tributary to Hunting Creek (2 sites), Unnamed tributary to Mill Creek, and Mill Creek. Mitigation site criteria included being sited on public land, within the floodplain, existing wetlands, and hydric soils. Sites were ranked from most desirable to least desirable: 1) former wetlands, 2) disturbed or idle land without large trees, 3) farmed land, 4) disturbed land with small trees, and 5) disturbed land with large trees. No mitigation sites were found**.** Since most wetlands are found along the steep-sided valleys, development, and therefore direct wetland loss, is unlikely in these areas. This plan suggests that mitigation should be allowed to include out-of-kind practices (e.g. streambank stabilization). In this plan, additional buffers were recommended for steep slope areas, on-site stormwater management, vegetated buffer strips, and preserving forest cover.

Calvert County has hired the local Soil Conservation District (SCD) to conduct a detailed survey identifying potential sites for wetland mitigation in the County. As part of this survey, they are evaluating topography and soils, and conducting field visits. Desirable sites would be marginal cropland that could provide water quality benefits. The SCD wants to avoid prime farmland and are not intending to remove large farm parcels from production. Since many sites in this County are within agricultural preservation and agricultural easements, the SCD is considering these sties as well. While the land owners have not been contacted yet about potential restoration on their property, the SCD is finding many sites that fit their criteria. Results from this study will be the property of the Department of Public Works, and will be used to meet their mitigation requirements.

The 2002 document entitled *Land Use and Water Quality in Hunting Creek: Research, Education, and Outreach* is summarized as follows. Three tributaries of Hunting Creek were monitored for benthic and water quality. University of Maryland Center for Environmental Science Institute for Ecological Economics developed a landscape model to look at water quality impacts of land use and potential build-out. Based on this model, they had the following recommendations:

- Development within the stream buffer should be restricted so the increase of nitrogen load will be reduced.
- Septic fields should be redesigned to allow effluent to enter root zone, rather than groundwater, to improve water quality.
- Alternative land use practices should be considered over lawns (e.g. natural vegetation).

The watershed contains two examples of high quality, relatively undisturbed tidal wetland shrub communities. The sites serve as reference sites for their community types. The community dominated *Baccharis halmifolia/Iva frutescens/Panicum virgatum* (Groundsel tree/Marsh elder/Switch grass) is daily to irregularly flooded by mesohaline waters. The second community type is dominated by *Iva frutescens/Spartina*

cynosuroides (Marsh elder/Big cordgrass) and is also daily or irregularly flooded by mesohaline waters.

There are two State-designated Wetland of Special State Concern in this watershed and two potential WSSCs.

- *Battle Creek Cypress Swamp*. This swamp has one of the last remaining bald cypress stands in Maryland, including many large mature bald cypress trees. This area also provides good habitat for species such as mink, pileated woodpecker, and pineland tree frog. This area is partially protected by The Nature Conservancy Battle Creek Preserve and development is severely limited on adjacent land. Agricultural activities upstream have the potential to impact the swamp (MDP, 1981).
- *Patuxent Highlands*. This wetland contains a rare plant species. This wetland is at the base of a ravine and has good water quality due to the majority of the watershed being forested. A small portion of the northern side of the wetland has been cleared for lawn. This site is only partially protected by Hall creek NRMA. Main threats include logging/forest clearing resulting in runoff and erosion. The lawn area should be restored to natural vegetation (McCarthy et al., 1988).
- A 2002 potential WSSC is located along St. Paul Branch and is mostly within a County-owned landfill, so may be vulnerable.
- A 2002 potential WSSC is located along Hunting Creek and is unprotected.

The 2003 Stream Corridor Assessment surveyed three subwatersheds (Hall creek, Island Creek, and Back/Mill Creeks) for a total of 130 stream miles. They found 101 potential environmental concerns. The most common problem was erosion (39 sites, including 20 within Hall Creek subwatershed, 14 within Island Creek subwatershed, and 5 within Back and Mill Creek subwatersheds). The majority of these were ranked moderate in severity and were at sites with forest on both sides, suggesting upstream sources are the cause. One site in Hall Creek was ranked as very severe, with 7-foot banks and 13,000 linear feet of erosion. Other problems were fish passage barriers (22 sites with minor to moderate severity) caused by road crossing, natural barriers, in-stream pools, or dams. Inadequate stream buffers were found at 13 sites (ranked between minor and moderate), estimated at 3,100 feet of inadequate stream bank within the subwatersheds sampled. The most common land use on areas with inadequate stream buffers were lawns, with one site having livestock present. Other concerns were pipe outfalls (11 sites), trash dumping (11 sites), and channel alteration sites (5 sites) (Pellicano and Yetman, 2004).

There are no streams within this watershed listed on DNR's Fish Blockage database, which is separate from the above-mentioned stream corridor assessment.

The WRAS Watershed Characterization for this watershed suggested establishing stream buffers, especially headwater stream buffers. They suggested restoring wetland stream buffers on areas with hydric soils, agricultural land, and within 50 feet of a stream. They also suggested restoring wetlands in areas with hydric soils, on cropland or pastureland, within 100 feet of existing wetlands. It is also desirable to focus efforts where there will be a measurable improvement (e.g., a first order stream). The 1994 Hall Creek Watershed

Water Quality Management Plan was developed to reduce nutrients, which were mostly nonpoint sources. Recommendations included agricultural BMPs, removing highly erodible land from production, urban nutrient management, stormwater management, septic system improvements, and improved growth management (DNR, 2003a).

The WRAS strategy (Center for Watershed Protection, 2004) outlines the goals of:

- Reduce water quality entering into the Lower Patuxent River by focusing on nonpoint sources.
- Increase understanding of issues and encourage action by commercial and residential parties.
- Reduce impact of future growth on Patuxent River.
- Protect and restore sensitive natural resources (contiguous and Interior Forest, sensitive areas, and stream buffers).
- Protect character and quality of life.

Addition recommendations (Center for Watershed Protection, 2004):

- Install living shoreline techniques in Island Creek area.
- Restore and protect areas within Hall Creek subwatershed, protect areas within Island Creek subwatershed, and restore areas within Solomons Harbor subwatershed.
- Protect Ecologically Significant Areas through long-term preservation.
- Once the strategy for reducing nitrogen pollution from septics systems is complete for Solomons Harbor, expand the strategy to the entire watershed.
- Restore Battle Creek shoreline habitat including protecting the stream bank, creating over an acre of tidal marsh, creating an oyster bar, and erosion and archaeological site protection.
- Create streambank stabilization demonstration project in Halls Creek subwatershed. This would entail removing an out-of-use driveway culvert and stabilizing the area downstream.
- Assess stormwater retrofit options.

The Center for Watershed Protection reevaluated some of the stream sites identified as having moderate to severe stream erosion during the stream corridor assessment. They found at least two potential restoration sites in Hall Creek subwatershed. The Center for Watershed Protection also completed a contiguous forest assessment for Island Creek subwatershed. In this assessment, they found that the areas were younger and more fragmented than as appears in the GIS data.

Impervious surface based on 2000 MDP land use data found that only Solomons Harbor subwatershed exceeded the 10% threshold for impervious surface. Above 10%, stream quality indicators decline and are considered “impacted.” Based on developable land use and zoning, future impervious surface could bump Hall Creek, Graham Creek, and Hunting Creek into the >10% impervious surface category as well. The County has made recent efforts to downsize growth and focus growth into town centers. This will greatly reduce the amount of future impervious surface.

Specific Restoration Recommendations

- Restore gaps in designated Green Infrastructure back to natural vegetation, especially around waterways.
- Consider out-of-kind restoration, including streambank stabilization and stormwater management.
- Establish stream buffers, especially headwater stream buffers. Restore wetlands within the headwaters.
- Restore sensitive natural resources (e.g. contiguous and Interior Forest and sensitive areas).
- Install living shoreline techniques in Island Creek area.
- Restore areas within Hall Creek subwatershed and within Solomons Harbor subwatershed.
- Restore Battle Creek shoreline habitat including protecting the stream bank, creating over an acre of tidal marsh, and creating an oyster bar.
- Restore streams based on findings from 2003 Stream Corridor Assessment (Hall creek, Island Creek, and Back/Mill Creeks): erosion, fish passage barriers, and inadequate stream buffers (Pellicano and Yetman, 2004).
    - Based on recommendations from the *Patuxent River Policy plan: An update for 1984 to 1997* (DNR, 1997):
        - Riparian forest - stabilize stream banks.
        - Stream quality - to improve spawning ranges.
        - Wetlands, submerged aquatic vegetation, and tidal marsh.
        - Forest land - to enhance contiguous tracts of forest.

Specific Preservation Recommendations

- Protect currently unprotected Green Infrastructure, especially around waterways.
- Protect high priority areas within the Rural Legacy Area.
- Protect any portions of the WSSCs and surrounding buffer that are not currently protected.
- Protect additional wetlands within designated Ecologically Significant Areas.
- Protect wetlands used as reference sites in the DNR study of tidal wetland vegetative communities (these are along the St. Leonard Creek).
- Protect sensitive natural resources (contiguous and Interior Forest, sensitive areas, and stream buffers).
- Protect areas within Hall Creek subwatershed and protect areas within Island Creek subwatershed.
- Protect wetlands and streams within the headwaters.

<u>West Chesapeake Bay (02131005)</u>

Background

Based on MDP 2002 GIS land use data, the Calvert County portion of the West Chesapeake Bay watershed has 665 acres of open water and 36,901 acres of land. The land acres are divided as follows: urban 10,559 acres (29%), agriculture 3,615 acres (10%), forest 21,840 acres (59%), wetlands 868 acres (2%) and barren land 18 acres

(<1%). Since MDP estimates of wetland acreage are often underestimated, better estimates, based on DNR wetland data, are present later in this document.

Randle Cliff Beach, Camp Roosevelt Cliffs, Flags Pond, and Cover Point Marsh are designated Natural Heritage Areas within this watershed. 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. 1079 acres within Calvert Cliffs State Park is included in the Maryland Wildlands Preservation System, suggesting the protected area has retained its wilderness character and/or contains rare species or habitat.

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

- Estuarine
    - Emergent: 1,237 acres
    - Scrub shrub: 5 acres
    - Unconsolidated shore: 170 acres
- Palustrine
    - Aquatic bed: 5 acres
    - Emergent: 320 acres
    - Scrub shrub: 92 acres
    - Forested: 3,393 acres
    - Unconsolidated bottom: 153 acres
    - Unconsolidated shore: 16 acres
    - Farmed: 1 acres
- Total: 5,392 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 (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02131005	-7.19	12.37	1.30	0	6.48

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. For the Calvert County portion they are as follows:

- Use I: water contact recreation and aquatic life; all portions except those described below.
- Use II: shellfish harvesting; all estuarine portions of tributaries.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. It is also classified as a Category 3, a pristine or sensitive watershed in need of protection. Failing indicators include poor non-tidal benthic index of biotic integrity (BIBI) and fish index of biotic integrity (FIBI), high population density, and high soil erodibility (0.30). Wetland loss was estimated to be 12,960 acres. Indicators for Category 3 include high percent headwater streams within Interior Forest (47%) and high percent of the watershed being forested.

Source water assessments were completed for several water supplies within this watershed (in addition to SWAs completed for County-wide water supplies). The water supply name and susceptibility are as follows:

- *Dares Beach*: naturally occurring radiological contaminants (depending on approved maximum contaminant levels).
- *Kenwood Beach*: naturally occurring radiological contaminants (depending on approved maximum contaminant levels).
- *Paris Oaks*: naturally occurring radiological contaminants (depending on approved maximum contaminant levels).
- *Scientist Cliffs*: naturally occurring radiological contaminants (depending on approved maximum contaminant levels).
- *Western Shores*: naturally occurring radiological contaminants (depending on approved maximum contaminant levels).
- *Chesapeake Heights*: naturally occurring radiological contaminants (depending on approved maximum contaminant levels).
- *Calvert Beach*: naturally occurring radiological contaminants (depending on approved maximum contaminant levels).

The 2002 305(b) report found that tidal tributaries along the western shore of the Bay fail to support all uses due to bacteria from nonpoint sources, failing septic systems, and natural sources (poor tidal flushing). A portion of the sampled nontidal, wadeable tributaries also failed to support all designated uses due to a poor biological community and siltation from habitat alteration and changes in hydrology.

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:

- *West Chesapeake Bay* (tidal); nutrients, sediments
- *Herring Bay* (tidal in Anne Arundel County); fecal coliform.
- *Tracy Creek* (tidal in Anne Arundel County); fecal coliform.
- *Rockhold Creek* (tidal in Anne Arundel County); fecal coliform.
- *Parker Creek* (021310050976 non-tidal in Calvert County); sediment.
- *Parker Creek Unnamed Tributary* (021310050976 non-tidal in Calvert County); sediment.
- *Plum Point Creek* (021310050977 non-tidal in Calvert County); poor biological community.

- *Plum Point Creek Unnamed Tributary* (021310050977 non-tidal in Calvert County); poor biological community.
- *Fishing Creek* (021310050978 non-tidal in Calvert County); poor biological community.
- *Fishing Creek Unnamed Tributary* (021310050978 non-tidal in Calvert County); poor biological community.

Restoration/Preservation

The majority of this watershed is designated Green Infrastructure hub (DNR, 2000-2003). Protected land includes Calvert Cliffs State Park, American Chestnut Land Trust, U.S. Naval Research Lab, and MET holdings. According to the Maryland Greenways Commission, there are several existing or proposed recreational greenways.

- *Baltimore-Drum Point Rail Trail*: This potential recreational trail runs north-south through the County.
- *Battle Creek to Parker's Creek Greenway*.
- *Chesapeake Beach Rail Trail*.
- *Flag Ponds to Solomons Trail*.
- *North Beach Baywalk*.

The following information is summarized from the document *Rural Legacy FY 2003: Applications and State Agency Review*. The Rural Legacy area within this watershed is Battle Creek/Parker's Creek, sponsored by Calvert County. This County is experiencing some of the highest growth rates in the State, so there is a need to preserve this land. Battle Creek/Parkers Creek includes 9,300 acres of mostly undeveloped land south of Prince Frederick, in the watersheds Battle Creek and Parkers Creek. The intent of the Rural Legacy Program is to preserve large adjacent parcels, thereby creating a greenbelt of protected land from Patuxent River to the Chesapeake Bay. This is also intended to reduce development and preserve farmland. The area contains prime farmland, forest (including the northernmost stand of bald cypress), and a significant diverse ecosystem (including some significant wetland areas). According to this document, 74% of the designated areas have been preserved, connecting the mouths of Battle Creek and Parkers Creek. Calvert County plans to protect 8,504 acres total within this area. This Rural Legacy document provides a list of property owners within the Rural Legacy area who are interested in putting their land into an easement and the priority of acquiring these easements. Sites ranked as high priority may be potential protection sites for other programs.

A watershed management plan has been completed for Parkers Creek in 2001 (Calvert County, 2001). The following information is summarized from this report. Parkers Creek watershed is the most pristine watershed in the County and includes a unique combination of healthy fresh and salt water marsh, unfragmented forest, streams, and high cliffs. Within this watershed, 76% of the land is forested and 80% of this forested land is classified as Interior Forest. Several rare, threatened, and endangered species are present within this watershed. Since Prince Frederick is within the watershed, the pristine natural areas within the watershed are threatened by future development. Development

should be focused around Prince Frederick, while preserving the mid and lower portion of the Parkers Creek watershed. Recommendations include:

- Preserve and improve wildlife corridors and habitat, eastern 2/3 of watershed, and large forests and riparian forests.
- Preserve non-polluting agriculture.
- Encourage ecological research.
- Maintain water quality through monitoring and reducing impacts from development.
- Preserve land while maintaining property values.
- Protect floodplains.
- Protect groundwater quality and quantity.
- Reduce mitigation requirements within the town center, while developing a mitigation bank within the watershed.

The document entitled *Parkers Creek Watershed Wetland Assessment* (Chris Athanas, Ph.D & Associates, Inc. and Dewberry and Davis, 1995) is summarized as follows. The majority of wetlands were palustrine forested, temporarily flooded. 52 of the 88 NWI designated wetlands within this watershed were assessed for wetland function, results which are mapped within the document. The non-tidal eastern wetlands have functions of pollution removal/transformation and water-dependent wildlife. Wetlands not adjacent to the mainstem, including along the smaller creeks, are mostly forested and provide the functions of exporting organic material to Parkers Creek, removing sediment and nutrients, and providing habitat. Some of the threats to the wetlands are from road crossings (sedimentation during construction), poorly-sited stormwater basins, and fragmentation. Steep slopes in this watershed may result in high sediment erosion during construction and from stormwater runoff. Protection measures should focus on the easternmost large freshwater wetlands along the mainstem Parkers Creek and on the forested uplands. Mitigation site criteria included being sited on public land, within the floodplain, existing wetlands, and hydric soils. Sites were ranked from most desirable to least desirable: 1) former wetlands, 2) disturbed or idle land without large trees, 3) farmed land or land with young trees, and 4) undisturbed land (including land with large trees). While there were a few sites ranked as 1 or 2, closer inspection revealed they were not in good topographic positions. Only one viable site was identified using these criteria. For this reason, this plan suggests that mitigation be allowed to include reforestation of uplands and more importantly, try to avoid wetland impact in the first place.

There are five State-designated Nontidal Wetlands of Special State Concern in this watershed and one potential WSSC.

- *Calvert Cliffs State Park*. This area contains streams running through a large tract of fairly undisturbed old forest. This site contains forest interior dwelling species, good water quality, and high potential for educational and recreational activities. This site is entirely protected by Calvert Cliffs State Park. Main threats include logging/forest clearing. Some erosion occurs along existing roads and trails (McCarthy et al., 1988).
- *Cove Point Marsh Natural Heritage Area*. This is a baymouth barrier wetland with extremely high vegetative richness. A 1996 floristic survey of the Cove Point

area (including uplands) found forty-one RTE species (Sipple, 1999). This area is protected by a MET (owned by the Cove Point Liquid Natural Gas Plant).
- *Flag Pond Natural Heritage Area*. This area is protected by Flag Ponds Nature Park.
- *Port Republic Watershed*. This area contains seepage wetlands, circumneutral soils, and old non-fragmented forest resulting in the presence of six rare species, forest interior dwelling species, and amphibians habitat. This area is unprotected. The main threat is logging/forest clearing and potential Gypsy Moth infestation (McCarthy et al., 1988).
- *Randle Cliff Beach NHA*. This area is currently unprotected.
- *West Governor Run Watershed*. This mature hardwood forest contains circumneutral soils, seven rare plant species, and forest interior dwelling birds. This area is mostly protected by American Chestnut Land Trust. Main threats are logging/forest clearing and possible Gypsy Moth infestation (McCarthy et al., 1988).
- There was an additional WSSC proposed in 2002, currently unprotected, in the headwaters of Parker Creek.

Specific Restoration Recommendations
- Restore gaps in designated Green Infrastructure back to natural vegetation, especially around waterways.
- Reduce mitigation requirements within the town center, while developing a mitigation bank within the watershed.
- Allow mitigation to include reforestation of uplands and more importantly, try to avoid wetland impact in the first place.
- Restore wetlands and streams within the headwaters.

Specific Preservation Recommendations
- Protect currently unprotected Green Infrastructure, especially around waterways.
- Protect high priority areas within the Rural Legacy Area.
- Protect any portions of the WSSCs and surrounding buffer that are not currently protected.
- Protect additional wetlands within designated Ecologically Significant Areas.
- Preserve and improve wildlife corridors and habitat, eastern 2/3 of watershed, and large forests and riparian forests.
- Protect floodplains.
- Protect groundwater quality and quantity.
- Protect the eastern large freshwater wetlands along the mainstem Parkers Creek and on the forested uplands.
- Protect wetlands and streams within the headwaters.