St. Mary’s River
Watershed Characterization
Spring 2016

Prepared by the St. Mary’s River Watershed Association, Inc. in partnership with St. Mary’s County Government, Maryland Department of Natural Resources, St. Mary’s College of Maryland, and local agencies and businesses.
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a supporting document to the
Watershed Restoration Action Strategy
for the
St. Mary’s River

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and local agencies and businesses.

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GLOSSARY

**Critical Areas:** areas within 1000 feet of tidal wetlands are designated as critical areas and have special restrictions and regulations concerning development and construction within the designation.

**Estuary:** Region of transition from freshwater rivers and streams to marine systems, usually physically protected systems like bays, deltas, coastal plains, etc. Estuaries often contain unique ecosystems, high biodiversity, and high productivity; these features make estuaries ecologically, aesthetically, and commercially valuable.

**Estuarine wetlands:** Tidal wetlands which occur in coastal and estuarine systems. Estuarine wetlands are typically in brackish or fully saline environments.

**Palustrine wetlands:** Non-tidal wetlands which are substantially covered in emergent vegetation. Palustrine wetlands are usually normally freshwater environments, but can be saline in arid/semi-arid climates.

**Riparian:** the land area adjacent to a stream or river bank.

**SAV:** Submerged aquatic vegetation; one of the most prominent species in the Bay is eelgrass.

**TMDL:** Total Maximum Daily Load, the maximum daily amount of a particular pollutant for a particular water body that still allows for adequate water quality and ecological integrity. Separate TMDLs are calculated for every pollutant/water body combination in the US. TMDLs are part of a “pollution diet,” a regulatory effort to restrict the amount of pollution entering waterways for the purpose of restoring water quality.

**Watershed:** the drainage basin for a given body of water. Watersheds can be small (e.g. drainage area of a small creek) or large (e.g. Chesapeake Bay watershed, encompassing several states).

**WIP:** Watershed Implementation Plan, a comprehensive strategy to achieve TMDL allocations for waterbodies listed as “impaired” under section 303(d) of the Clean Water Act. WIPs have three phases: Phase I and II WIPs lay the groundwork for immediate and near-future efforts to meet TMDL allocations and achieve water quality standards, while Phase III allows for reassessment and long-term goal setting once phases I and II are underway.
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As the largest watershed in St. Mary’s County, the St. Mary’s River watershed encompasses 70.6 square miles, or almost a quarter of the county’s land. While having the distinction of lying fully within St. Mary’s County, the watershed is also part of the larger Lower Potomac River Basin. Drained by 174.9 miles of streams, this eight-digit watershed (02140103, Maryland Department of Natural Resources) consists of 10 smaller subwatersheds with numerous creeks and major tributaries that feed into the St. Mary’s River. Near St. Mary’s City, the 22.3 mile-long main stem of the St. Mary’s River widens into a tidal estuary, which at its 2-mile wide mouth flows into the lower Potomac River (See Map 1).

The Maryland Department of Natural Resources has described the St. Mary’s River as a “stronghold watershed,” reflecting its role as habitat for regionally endangered and state threatened species. However, the St. Mary’s River is currently listed as “impaired” under section 303d of the Clean Water Act. Projected population growth and commercial development in St. Mary’s county is also likely to threaten the health of this ecologically and commercially important stronghold watershed.

This St. Mary’s River Watershed Characterization Report, produced by the St. Mary’s River Watershed Association and partners, summarizes all readily available information concerning the watershed’s natural and social resources. Our purpose in preparing this document is to provide the informational basis for public policy decisions on land use, storm water and waste management in ways consistent with the conservation and protection, and, when needed, enhancement of the water quality and natural resources of the St. Mary’s River and its tributaries.

Towards this end, the Characterization Report includes information on heritage resources, river history, landscapes and land use, water quality, living resources, restoration, and conservation, and human needs and services. The data have been collected on a broad-based state level, as well as at regional and local levels. The document incorporates summaries of three research studies produced by Dr. Robert W. Paul of St. Mary’s College of Maryland with the assistance of the Watershed Assessment Division of the Maryland Department of Natural Resources (DNR): The Synoptic Survey Report, the St. Mary’s River Stream Corridor Assessment and Tidal Shoreline Survey, and the Water Quality Assessment.

Based on field research performed in 2008, the Synoptic Survey Report provides analyses of water chemistry (nutrients, temperature, conductivity, and pH), biological surveys of benthic macroinvertebrates and fishes, and habitat surveys for 15 freshwater sites and 1 tidal site.

The Stream Corridor Assessment (September 2008) summarizes the results from a field study of 118-miles of non-tidal streams using MDNR's Stream Corridor Assessment Methodology. With
permission granted to access 68% of the stream corridors in the watershed, researchers walked streams to assess problems such as pipe outfalls, erosion sites, lack of buffers, fish passage blockages, sewer outfalls, or unusual conditions. The research team provides geographically referenced information.

The Water Quality Assessment (September 2008) is a comprehensive scientific compilation of detailed water quality information collected from 1999 through 2008.

These three reports can be found at the St. Mary’s River Watershed Association website:


The St. Mary’s River Watershed Plan, an action strategy to promote the health and future of the river and its surrounding drainage area, was developed in 2012 by the St. Mary’s River Watershed Association in partnership with the Center for Watershed Protection and St. Mary’s County government. As consultant and lead author, the Center was tasked to do extensive surveys, utilize the previously mentioned technical information, and to incorporate local knowledge through the involvement of a local stakeholder committee made up of government officials, business interests, and community members. This strategy includes:

- a well-stated, overarching goal aimed at protecting, preserving, and restoring habitat and water quality
- a description of the stakeholder process
- a detailed, prioritized description of natural resource management objectives
- a prioritized list of feasible storm water mitigation and restoration projects and the associated cost estimates
- information on funding opportunities for recommended projects
- a description of evaluating implemented project efficacy through continued long-term monitoring
Significant historic sites abound in the St. Mary’s River watershed. St. Mary’s City, located on the banks of the tidal St. Mary’s River, was founded as the fourth permanent English settlement in the New World and served as Maryland’s capital until 1695.

Recognized as the birthplace of religious tolerance, this is also the site where the first African American descendent voted in Maryland and where women launched the fight for voting rights. Today, the state of Maryland has secured St. Mary’s City as a living museum on several hundred acres. It features a working plantation, a replica oceanic vessel, and a state-of-the-art interpretive center.

St. Mary’s City also boasts extensive archeological opportunities and partners with St. Mary’s College of Maryland’s museum studies undergraduate program.

Despite its rich heritage, few other historic sites in the watershed have been preserved. Only the Drayden Schoolhouse has been preserved, interpreted, and opened to the public. In addition, the Navy runs a large research facility on the east bank of the tidal river.

Throughout history, as well as the modern era, the river has provided valuable resources to area inhabitants and has been an important factor in regional water-based economies.

Nearly half of the St. Mary’s County population — 46,000 people — live within the St. Mary’s River watershed. As shown in Map 2, the 45,198-acre watershed extends from St. Mary’s County Regional Airport in California south to St. George’s Island and Kitt’s Point at the mouth of Smith creek.

Land use in the watershed is varied and typical of the southern Maryland region. In 2007, over half of St. Mary’s County (121,400 acres), while about a quarter (54,800 acres) was devoted to agriculture. In 2010, 21% of the watershed was urbanized, with an additional 3% covered by impervious surface. The largest portion of developed land consists of residential areas; however the majority of the county’s targeted development occurs along a 7.5-mile stretch in the St. Mary’s watershed, in the area known as the Lexington Park Development District. Business parks and commercial areas are extensive and growing from Hollywood south and Route 235 west through Lexington Park. Other business


2 Watershed Report for Biological Impairment of Non-Tidal St. Mary’s River Watershed, St. Mary’s County, Maryland Biological Stressor Identification Analysis Results and Interpretation. 2014. Maryland Department of the Environment.
centers occur along Great Mills Road and Route 5 in Great Mills and Callaway. Industrial uses, such as mining, are confined to small parcels of less than 250 acres.

Landscape indicators of environmental health include the percentage of impervious surface area in a watershed, population density, historic wetland loss, streams lacking forested or planted riparian areas, or buffers, and soil erodibility. General downward trends are evident in all of these indicators.

Large contiguous protected areas exist in the upper central watershed. They are the St. Mary’s River Wildlands, the St. Mary’s Lake State Park, and the former Bevan properties and the Walton Lumber Company — both purchased with open space funds in 2004 and 2015, respectively, and now known as Salem State Forest in somewhat the same vicinity is St. Mary’s Lake State Park. Other protected lands are scattered throughout the watershed.

Vulnerability to storm inundation and sea level rise is limited to areas immediately adjacent to tidal areas. The St. George Island community is especially vulnerable to sea level rise as access to/from the island becomes blocked by flood waters. In recent years, even minor storm events have flooded streets. Islanders report an increase occurrence of access disruptions over the past three years (2012-2014) compared to the twenty years prior (1992-2011).

“Just in the past few years the island was inaccessible five times. The bridge has not been closed that many times in the twenty years prior to that.”
—Viki Volk-Russell, resident St. George Island at the Q&A session following a lecture at St. Mary’s College of Maryland by Rear Admiral Jonathon White; November 2014.

St. Mary’s River delta area.
WATER QUALITY

The water quality of the St. Mary’s River and its tributaries has been monitored repeatedly over the past 13 years. Overall, the St. Mary’s River watershed has fair to good water quality; however, research indicates that increased urbanization and related pollution poses a potential threat if not managed. A statewide assessment of all watersheds identified the St. Mary’s River watershed as a sensitive watershed in need of an extra level of protection.

Even so, the watershed does not support all the designated uses assigned to it by state regulations. Some areas are restricted for shellfish harvesting, and a fish consumption advisory exists for all waters. Additionally, some first- through fourth-order streams are impaired for aquatic life. The cause of the impairment is unknown. High levels of nutrients in storm water runoff have fueled algal blooms and low levels of dissolved oxygen in the tidal St. Mary’s river (when large populations of algae die and decompose, the oxygen available in the water for aquatic life is reduced). Low pH, erosion and sediment deposition also have been identified as problems in some areas of the watershed.

Studies have cited storm events as a leading cause of perturbation in St. Mary’s River, as nutrients and sediments are transported into the tidal main stem from various tributaries in the watershed and as far away as the development district.

LIVING RESOURCES

The St. Mary’s River watershed is comprised of tidal and non-tidal aquatic and terrestrial habitats. Unique habitats in the watershed include wetlands, oyster reefs, submerged aquatic vegetation (SAV) beds, and forests. These areas provide critical ecosystem services for native wildlife and humans.

Wildlife monitoring enables impacts on the environment to be readily identified, facilitating watershed management and restoration. In the watershed, living resources are predominantly influenced by development and resource extraction.

Significant declines in SAV have been observed in the St. Mary’s River, with limited success of eelgrass restoration efforts. Annual summer diebacks reflect trends experienced throughout the Chesapeake Bay as a result of excess nutrients and high summer temperatures. Commercial fisheries in the St. Mary’s River include oysters, perch, menhaden, croaker, spot, striped bass (rockfish), and blue crabs. Striped bass and blue crab fisheries have declined, with low annual recruitment of juvenile blue crabs and a depleted striped bass stock.

Freshwater fish and benthic macroinvertebrates have been surveyed in the non-tidal St. Mary’s River by the Maryland Department of Natural Resources. Their findings indicate a high level of species diversity, with common species such as trout, bass, and pickerel being present. However, there are concerns about the health of these species due to the pollution issues in the watershed.
Resources in 1995 and by St. Mary’s College of Maryland between 1999 and 2008. Poor stream heath, associated with low species abundance and diversity, was identified at a few highly urbanized sites.

Currently, the St. Mary’s River supports thriving oyster bars, with low disease prevalence and high natural recruitment. The success of the oyster population in the river is due to recent oyster restoration and establishment of an oyster sanctuary in 2010 for tidal areas north of Church Point.

The St. Mary’s River watershed also supports various migratory and resident bird species. Comparative studies suggest that breeding has not been impacted for most species in the area.
The St. Mary’s River watershed has experienced substantial increases in its population, with subsequent need for the revitalization of housing and welfare, employment, and infrastructure in the county. Incidences of homelessness and drug addiction are increasing, requiring the development of strategic plans, county-based prevention programs, and the expansion of shelters and rehabilitation facilities. County plans recommend that incentives be provided for the creation of diverse housing opportunities.

Local shelters and the St. Mary’s Caring Soup Kitchen have reported increases in annual numbers of beds and meals provided. County and non-profit organizations are providing resources and programs to provide emergency care and counseling for those in need.

Employment in the county is predominantly generated by the Naval Air Station Patuxent River, but also includes water-based economies: marinas, recreation, commercial fishing, and seafood sales. Green initiatives, aquaculture development, and large-scale oyster restoration efforts in the St. Mary’s River have all helped to mitigate environmental impacts.

Ongoing improvements to roads and public transit will encourage mixed-use transit and alleviate traffic congestion. Proposed greenways would connect the county by biking, hiking, and paddling trails. Wastewater systems are being updated to meet new regulatory quotas for effluent discharge into the Bay.

Several reports have identified necessary watershed restoration projects, including a 2009 Army Corps of Engineers report, the 2001 Upper St. Mary’s River Baseline Watershed Assessment, the Center for Watershed Protection’s Watershed Plan, and the county’s ongoing Watershed Implementation Plan. Additional reports, including the VIMs Performance of SILS, provide insight into effective restoration methodology.

These reports recommend a variety of restorative actions and ongoing conservation in order to enhance ecosystem health. Recommended actions include management of storm water and agricultural runoff, upgrades of septic systems to best available technologies (BAT) standards, and conservation and restoration of crucial habitat in the watershed.

Storm water can be managed through incorporation of retrofits and best management practices (BMPs). Agriculture can contribute nutrient and sediment pollution to the watershed, but management practices can significantly reduce

3Ibid (St. Mary’s County comprehensive plan, page 138)
4Ibid (Watershed Report for biological impairment)
7Refer to Section 8-7 for more information
pollution. Septic systems release large amounts of nitrogen pollution to nearby streams, but can be upgraded to reduce nitrogen pollution by up to 50%. Habitat conservation and restoration provides important ecosystem services to humans and wildlife.

Other conservation practices which can help mitigate impacts on the environment include energy conservation, smart growth, forest retention, potable water conservation, Leadership in Energy & Environmental Design (LEED), renewable energy use, and a variety of public programs and incentives.
CONTRIBUTORS TO THE WATERSHED CHARACTERIZATION

WRAS STEERING COMMITTEE

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Print format of this document is on 100% recycled paper. This and other referenced documents can be found online or downloaded from www.StMarysRiver.org. Digital copies can be requested from St. Mary’s River Watershed Association, PO Box 94, St. Mary’s City, MD 20686.
BACKGROUND

The 1998 Maryland Unified Watershed Assessment identified areas of high priority for restoration and conservation based on natural resource value and waterway impairment. The Assessment was conducted by the Environmental Protection Agency’s Clean Water Action Plan initiative, the Maryland Department of the Environment, Agriculture and Planning, and the University of Maryland. Given the findings of this assessment, local governments have been developing and implementing Watershed Restoration Action Strategies (WRAS) to address restoration and conservation needs in the high priority watersheds, such as the St. Mary’s River watershed.

Activist Bernie Fowler along with other former public officials, fishing organizations, and the Chesapeake Bay Foundation filed a lawsuit in the district court of the District of Columbia, in January 2009, against the EPA claiming that EPA had failed to take adequate measures to protect and restore the Chesapeake Bay. [Fowler et al v US Environmental Protection Agency]. In May 2010 the parties reach a settlement that would establish a stringent Chesapeake Bay total maximum daily load (TMDL), putting in place an effective implementation framework, expanding its review of Chesapeake Bay watershed permits, and initiating rulemaking for new regulations for concentrated animal feeding operations and urban and suburban storm water. In May 2010, the EPA announced the federal strategy to clean up the Bay that requires establishment and implementation of a Chesapeake Bay total maximum daily load (TMDL) – a comprehensive program for controlling point- and non-point source pollution throughout the watershed. The EPA set up a system of accountability and tracking, established biannual milestones, and required and reviewed state watershed implementation plans (WIPs). Additionally, the EPA pledged to enforce federal consequences for non-compliance.

The establishment of the Bay TMDL and subsequent WIPs altered the focus of watershed plans away from the WRAS process to the jurisdictional-based WIPs. Regardless, since the St. Mary’s River watershed lies entirely within St. Mary’s County, the local entity charged with local implementation of the Bay TMDL, this Characterization and WRAS provides valuable insight and information for development of a county-wide WIP. Implementation requires funding and this WRAS document provides an additional competitive advantage when applying for and securing funding.

This Characterization Report of the St. Mary’s River Watershed was prepared by the collaborative efforts of the St. Mary’s River Watershed Association, Inc., in partnership with St. Mary’s County Government, Maryland Department of Natural Resources, St. Mary’s College of Maryland, local government agencies and businesses, and Historic St. Mary’s City. This report was produced through grant funding received in FY 2009 from the National Oceanic and Atmospheric Administration, the Chesapeake Bay Trust Stewardship program, in addition to monies pledged by the Boeing Company and Liberty Home Builder in affiliation with the St. Mary’s River Watershed Association.
The St. Mary’s River Watershed, which is contained in the southeastern quarter of St. Mary’s County and located in the Potomac River basin, hosts a network of small creeks and tributaries which drain into a tidal estuary, the St. Mary’s River. The St. Mary’s River watershed is comprised of 174 miles (280 km) of streams which feed into the upper reaches of the St. Mary’s River. The St. Mary’s River extends downstream to St. George’s Island and Kitt’s Point where it joins the lower Potomac River, which then flows into the Chesapeake Bay. The boundary of the watershed is shown on Map 1 and 2. Nearly half of St. Mary’s County residents live within the St. Mary’s River watershed and in recent years this population has increased significantly along Route 235 in the Lexington Park Development district. These substantial increases in urbanization are reflected in the health of local forests and streams in the watershed.

<table>
<thead>
<tr>
<th>St. Mary’s River Watershed Acreage Summary</th>
<th>MDP 2002 Land Use/Land Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>Water</td>
</tr>
<tr>
<td>35,230</td>
<td>3,220</td>
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PURPOSE OF CHARACTERIZATION

This Characterization report was prepared as part of the St. Mary’s River Watershed Restoration Action Strategy (WRAS), identifying the current status of the watershed. This plan presents a snapshot of the watershed in terms of its environmental issues, natural resources, and human development, needs, and impacts. By providing a solid baseline of environmental issues, associated plans and legislation, realistic restoration goals can be established. Additionally, this plan serves as a comprehensive summary of the watershed for the local government, businesses and residents.
HERITAGE: HISTORY OF HUMAN INTERACTIONS WITH THE WATERSHED

OVERVIEW

The current condition of the St. Mary’s River and its tributaries cannot be comprehended fully without some understanding of the human activities that occurred in the watershed over the previous four centuries. Human interaction with the environment from early colonial times until the present have influenced our drainage system greatly. Despite its predominantly rural nature, few aspects of the watershed or the St. Mary’s River can be considered “natural,” or unchanged. This section briefly reviews the history of human habitation and the impacts of land use on estuarine resources and vegetation.

PREHISTORIC PEOPLES (CA 11,000 B.C. TO 1600 A.D.)

Prior to the arrival of European settlers, Native Americans inhabited the St. Mary’s area for more than 12,000 years — from ca. 11,000 B.C. to 1600 A.D. Archaeological research has divided this broad time span into three major segments — the Paleo-Indian Period (11,000 B.C. to 8000 B.C.), the Archaic Period (8000 B.C. to 1000 B.C.), and the Woodland Period (1000 B.C. to 1600 A.D.). Each period is defined by general cultural traits, environmental conditions and key artifacts, (primarily stone projectile points and ceramics). The Archaic and Woodland periods are divided into a number of sub-periods thought to reflect changes in cultural development.

The most ancient evidence for humans found thus far in this area is a Clovis spear point from ca. 11,000 years ago discovered near the mouth of the St. Mary’s. There is abundant evidence of people residing along the river in the subsequent Archaic period with even more sites during the Woodland period. During these periods, it is unlikely humans had a significant effect upon the environment, with one exception — the use of fire to manage the forest understory, facilitate travel, stimulate the growth of browse vegetation for white tailed deer, and to drive deer in hunting. Data from other areas of the Chesapeake suggest that prehistoric peoples began using regular burning as a means of forest management as much as 6000 years ago. Hence, even the forests encountered by the first Maryland colonists were not, as they assumed, a reflection of purely natural conditions.

With the arrival of agriculture around 900 A.D., the Chesapeake Indians began to clear land for food production, employing a sustainable form of agriculture based on the use of hoes, slash and burn methods and long fallow periods. With this agrarian method only small land areas were in production at any given time. There was some intensification of agriculture in the period between ca. 1200 and 1600 A.D., but given its small scale and methodology, it had no measurable impact on the overall forested environment.

Although the early inhabitants and Chesapeake Indians of the St. Mary’s watershed cleared small forested areas for hunting and agriculture, their land-use practices made no appreciable changes to the ecosystems.

We only know the name of the most recent group of indigenous people to have lived on the St. Mary’s, the Yaoocomo Indians. It is difficult to determine their population at the time of the first settlers in the 1630s, but it estimated to have been no more than 500 people.
The St. Mary’s River — where Lord Baltimore’s colony began in 1634 — is one of the most historically significant locations in Maryland. Along the river, colonists built Fort St. Mary’s, the first Governor’s house, a Catholic chapel and the homes of the early settlers. The site became the capital for the Maryland colony from its founding until 1695, when the government was moved to Annapolis. St. Mary’s City is where the first government policy of religious freedom and non-establishment of religion was employed in the New World. The St. Mary’s River also saw development of the first tobacco plantations in the colony, as settlers gradually moved from Fort St. Mary’s in 1636 or 1637. In 1668, the first incorporated city in Maryland was established here. Another notable historical aspect of the river is that the first industrial activity in the colony occurred along it, beginning with a water mill in the 1630s, the first large scale brick manufacture, and an attempt to make iron in the mid-17th-century. And it was on the St. Mary’s River that the craft of printing began in all of English America outside of Boston.

Urban life along the St. Mary’s River declined following the departure of the provincial government in 1695 and the movement of the county government to Leonardtown in 1708. After 1708 it became a rural landscape, with large plantations, middling family farms, slave quarters, and poor tenant farms. A modest industrial complex did, however, arise a few miles north in Great Mills.

Poor agricultural practices, the American Revolution, and destruction by the British in the War of 1812 affected residents of the St. Mary’s River, causing some to depart to the frontier in search of new land. The river area remained rural with little population growth throughout the 19th and first half of the 20th centuries.

The U.S. Census data provides a good indication of the county’s stable population. From the first census in 1790 until the onset of World War II, the population of St. Mary’s County changed little. In 1790, there were 15,544 residents; in 1940, there were 14,626. Over that 150-year period, the lowest population occurred in 1820 after the trauma of the War of 1812, with only 12,794 county residents; the peak occurred in 1900 with 17,182 residents.

Dramatic changes to the county began in 1942 with the construction of the Patuxent River Naval Air Station. Initially, most impacts were restricted to the newly emerging Lexington Park area, but by the 1960s, population growth, residential construction, and economic development began to intrude on the St. Mary’s River drainage. One element was the expansion of military research and development activities at Webster Field on St. Inigoes Creek. Even more significant was the construction of new housing along the shorelines of the river, intensive commercial and residential development in the Lexington Park area, and the beginning of rapid growth of St. Mary’s College.
It is essential to recognize that the current conditions are a consequence of long-term natural processes and roughly four centuries of human actions. What was the river like in past centuries, when did major changes occur in its nature and what caused these changes?

When the first settlers arrived, the watershed was covered by forests, except for the areas farmed or burned by the Yaocomico peoples. During the 17th century, settlement was restricted to the lower, tidal portion of the river, while the upper drainage area above Great Mills remained forested. As tract maps developed by Historic St. Mary’s City reveal, it was not until the 18th century that settlers cleared the inland forests on lands suitable for agriculture. Due to the varied topography of interior areas, however, it is likely that many of the slopes and watercourses remained covered by vegetation.

Archaeological evidence from St. Mary’s City shows that the river contained a diversity of wildlife. The most common fish were benthic species, especially the sheepshead minnow, red drum, and black drum. Other species included white perch, sturgeon, and sea trout. Today, the sheepshead minnow and Atlantic sturgeon species are nearly extinct in the Chesapeake, while drums are rare in the St. Mary’s. Abundant oyster shell deposits indicate that Eastern oysters were prevalent in the river. Clam deposits are absent here, indicating that they were never a significant species. Attached organisms, or epifauna, on oyster shells include various sponges, oyster mudworms, and barnacles. In some archeological samples, oyster spat are common, suggesting that the St. Mary’s River in the past centuries once sustained a rich and vibrant benthic community, significantly different from today.

Because the St. Mary’s river drainage was covered by dense forests for thousands of years, nutrient inflows were stable and sedimentation rates low. The farming methods of Native Americans — shifting, letting fields lie fallow, and slash-and-burn methods — would have added little to the input of nutrients or sediment into the St. Mary’s River. Early English colonists adapted these same agrarian methods, using hoes for the production of corn and tobacco. Human impacts on the river ecosystem were negligible until farming transitioned to the plow. Although plows were present from the early 1600’s, the aboriginal method of hoe agriculture was still more efficient due to the extensive root systems of ancient, massive trees.

The human population grew rapidly after the mid-1600s, but reliance upon these agricultural methods would have generated only modest increases of nutrients and silt into the estuarine environment. The major consequence was a shift in the composition of the terrestrial vegetation, as forest clearing and agriculture promoted an increase in successional species such as ragweed, in newly open land.

In the late 1700s, especially after the Revolutionary War, economic factors caused Southern Maryland growers to shift from tobacco to more intensive grain production. Larger areas of soil were left exposed each year, significantly increasing in the quantities of sediment and nutrients entering the rivers and creeks of the region. This nutrient enrichment may have

initially enhanced the biological productivity of the estuarine environment. The upper courses of streams likely captured a substantial amount of sediment, but with major storm events silt would have been flushed into the main stem of the river. In this regard, the development of millworks in the Great Mills area may have helped reduce siltation in the river to some extent, since the mill ponds would have acted as unintentional sediment traps. Nevertheless, severe storm events would have inundated the benthic communities in the river with sediment. In some places, such as in Horseshoe Bay at St. Mary’s City, the bottom may have been covered with silt. Archeological evidence from the Tolle-Tabbs site, inhabited in the first half of the 19th century, suggests this. Food sample analysis showed that for the first time at any St. Mary’s City site, once-common benthic species like sheepshead and drum were absent from the settlers’ diet while consumption of pelagic fish increased. Gradual improvements in agriculture and some reforestation in the river area may have reduced the level of sedimentation slightly in the later 19th century.

The move to plow-based agriculture around the turn of the 19th century produced the first significant anthropogenic changes in the natural environment of the St. Mary’s River. Eutrophication of the river occurred, increasing primary biological productivity. After the Civil War, major commercial exploitation of oysters began. This included exploitation of the St. Mary’s River. Late 19th-century oyster maps indicate that the river contained a number of productive oyster bars and reefs, but over-harvesting in the late 1800s reduced this vital element of the ecosystem — the filter feeders that had helped reduce the negative consequences of excess nutrients and sediment. Even so, into the mid to late 20th century, the St. Mary’s River remained an important area for seed oyster production.

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3The Tolle-Tabbs site is a plantation house in St. Mary’s City, established in the 18th century and inhabited into the 19th century.
VEGETATION CHANGES IN THE ST. MARY’S RIVER DRAINAGE

Soil core sampling conducted at two sites in the St. Mary’s River basin provides historical data about the terrestrial vegetation that previously occurred here. One site, known as the Aud site, is located just downstream from where Route 5 crosses the St. Mary’s River. Based on radiocarbon dating, the Aud core sample extends back 6,380 years. The second core sampling site, which is in St. Johns Pond at St. Mary’s City, dates back 5339 years.

At the Aud site the oldest layer contains pollen from hemlock, likely a remnant of vegetation from the much colder preceding era. That sample also contains cedar, alder, birch and walnut, indicating that a marsh environment did not exist there 6,000 years ago. Higher in the core, however, in layers deposited after 2500 B.C., there is clear evidence that a marsh had developed by the presence of cattail, sedge and other marsh plants. Development of the marsh was likely related to sea-level rise, which occurred with the warming climate. Archeological evidence confirms that the Potomac River had estuarine conditions by 10,000 B.C., affirming the presence of marsh vegetation in the lower St. Mary’s River in that period.

Pollen in the Aud site core from around 500 A. D., revealed that holly was abundant, oak and black gum were common, and cinnamon fern, goldenrod, and arrowwood were present. The topmost layers contained large quantities of pine and ragweed, indicating that these were deposited after plow agriculture was underway.

Over the past 5000 years, there was little change to the forest composition in St. Mary’s City, retaining a mixed deciduous forest with some coniferous species. Oak and hickory were the most abundant trees, with maple, river birch, beech, ash, and sweet gum as major elements of the forest. Walnut, red cedar, some pine species, and perhaps chestnut were present in low frequencies. Chestnut, a poor pollen producer, was probably more common than the pollen samples suggest. Over 4,000 years ago, St. John’s Pond had a cattail marsh along its shores. Before approximately 2000 B.C., brackish to salt water had intruded into the pond area, supported by the presence of Mercenaria mollusk fragments.

The greatest change in the pollen record is associated with the arrival of Europeans in 1634. The primary changes were a decline in oak and hickory and increases in pine, ragweed, pigweed (chenopodium) and grasses. One significant feature of the pollen record at St. Mary’s is that pigweed increased greatly around the time of colonization but declined suddenly in the early 19th century. Palynologist Grace Brush suggests that the increase in pigweed was associated with the slash-and-burn and long-fallow agriculture methods used during the 17th and much of the 18th centuries. In contrast, ragweed significantly increased in the early 19th-century. It can be

[7] Mercenaria is a genus that include northern and southern quahog clams.
HISTORIC SEDIMENTATION RATES IN THE ST. MARY’S RIVER

associated with broad-scale land disturbance, which is consistent with the transition to plow agriculture in the late 1700s or early 1800s.

As described above, the historical record provides strong evidence of changes in land use and one can suggest the consequences of this on the estuarine environment. One consequence is sediment deposition. While sedimentation is a normal geological process, human activities can have a major influence on the extent of deposition. The analysis of the core samples at the Aud and St. Mary’s sites has also provided measurements of the annual deposition rate.

The sedimentation rates on the St. Mary’s River reflect this changing land use, as seen from the core sample data (Table 3-1). Research with census records has shown that in Southern Maryland in the early 1700s, about 1.4% of the land was used for the annual tobacco crop. By the 1770s, this rose to 3.6%.6 With the shift to grain production, the amount of land used annually for agriculture increased greatly — to nearly 40% by the 1830s.

Although these data come from marsh or pond settings, the deposition rates reflect the silt potentially entering the river itself. At the Aud site the sedimentation rate before ca 500 A.D. was only 0.005 cm/year. From ca. 500 to 1600, it rose to 0.03 cm/year. From the 1600s through 1700s, it was 0.05 cm/year.8,9 At St. Mary’s City in the millennia before English colonization, the rate was 0.14 cm/year,10,11 higher than at Aud during the that time period. The difference is probably explained by the presence of Chesapeake Indian settlements at St. Mary’s City, as indicated by archaeology. In the 17th and 18th centuries, deposition at St. Mary’s was 0.25 cm/year. During this period, human occupation was more intense at St. Mary’s than near the Aud site. With the rise of plow agriculture, the rate at St. Mary’s City increased still further, to 0.4 and 0.65 cm/year, confirming that the sedimentation rate into the St. Mary’s River changed significantly over time in relation to methods of land use.

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Aud Site</th>
<th>St. Mary’s City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre 500 A.D.</td>
<td>0.005 cm/yr</td>
<td>—</td>
</tr>
<tr>
<td>Ca. 500-1600 A.D.</td>
<td>0.03 cm/yr</td>
<td>0.14 cm/yr</td>
</tr>
<tr>
<td>Ca. 1600-1800 A.D.</td>
<td>0.05 cm/yr</td>
<td>0.25 cm/yr</td>
</tr>
<tr>
<td>Post 1820s</td>
<td>0.08 cm/yr</td>
<td>0.65 cm/yr</td>
</tr>
</tbody>
</table>

Given the increased sediment and nutrients entering the tributaries and St. Mary’s River, how did the biotic community in the St. Mary’s River respond to these changes? One way to address these questions is to examine the St. Mary’s River oysters collected from well-dated archaeological contexts. Due to the substantial level of archaeological research in the area, samples of shells dating from prehistory up to the present are available. Oysters can serve as sensors in an estuarine environment and reflect the changes that occur within it. Shell shape, growth rates, isotopic content, and attached epifauna, for example, can provide insights into past conditions.

Biologists Michael Kirby and Henry Miller conducted an analysis of oyster shell samples from 24 St. Mary’s and Patuxent River sites in an effort to examine the issues of eutrophication and shifts in the estuarine environment.12 Shell growth rates were one key data set collected by measuring shell length, shell thickness and the surface area covered by the abductor muscle, and determining the age of each oyster from growth ring analysis. Samples dating between the early 17th-century and the early 21st-century were used. Samples from sites along the lower portion of the Patuxent River were studied to provide comparative data.

Shell samples were divided into four temporal phases, based upon historical evidence regarding land use and harvesting intensity:

1. (ca. 1600 – 1760) Era of Hoe-based Agriculture
2. (ca. 1760-1860) Plow Based Agriculture and Limited Oystering
3. (ca. 1860-1920s) Era of Intensive Commercial Oystering

We assume that the Chesapeake Bay remained in a relatively stable condition for centuries due to a forest-covered drainage, and a massive population of filter feeders, especially oysters, that consumed much of the phytoplankton, especially diatoms, their preferred food. In such a situation, nutrients were converted into biomass, removed from the water column by filter feeders that in turn supported a rich marine fauna. Our study hypothesized that oysters would initially respond to the nutrient enrichment caused by the greater sedimentation from plow agriculture by an increase in growth. However, eutrophication continued to expand as commercial fishing began removing the majority of the Bay’s shellfish population, and growth began to decline due to degrading conditions, such as the onset of damaging algae blooms and hypoxia. For more information on algae blooms, refer to section 4-8.

The shells reveal notable changes (Table

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In both the St. Mary’s and the Patuxent, a significant increase in oyster growth occurred during the initial eutrophication period between the late 18th century and mid 19th century. Growth rates of oyster shells increased about 33% during this period. In both drainages, growth declined in the post-Civil War era. The decline is likely due to a substantial increase in nutrient inputs indicated by Zimmerman and Canuel’s analysis of nutrient levels in sediments from cores taken in the Chesapeake Bay. Overharvesting of filter feeder species also likely played a role in the 19th century declines in oyster growth. Oyster shell evidence shows similar responses by oysters in the St. Mary’s and Patuxent from the time of initial colonial settlement until the early 20th century. However, in the post-1920 period, the Patuxent and St. Mary’s data sets differ. Oyster growth rates on the Patuxent continue to decline while they return to early colonial rates on the St. Mary’s. This may be due to a relatively stable human population in the St. Mary’s area until late in the century and reforestation of substantial portions of the St. Mary’s River drainage in the 20th-century, with the consequent reduction of nutrient and sediment inputs. On the Patuxent, however, ongoing agriculture, the increase of residential populations and nutrient inputs from sewage and other sources is the likely reason oyster growth in that river continued a downward trend.

This evidence fits with the fact that the St. Mary’s River was still considered an important source of seed oysters by the Maryland Department of Natural Resources into the late 20th century. Shellfish data reveals notable changes over time related to variations in estuarine conditions that are ultimately linked to the nature of terrestrial land use. The later 20th-century shell evidence matches the findings from recent monitoring conducted by the St. Mary’s River project, indicating that excessive eutrophication is not as serious a problem here as is found in some other drainages. However, Dermo disease along with continued harvesting have further reduced the St Mary’s oyster population, leaving only a tiny remnant population of the once-abundant oyster in the St. Mary’s River.

The fact that the oysters responded to eutrophication by higher shell and soft tissue growth rates shows that they were consuming a portion of the greater primary biological production occurring in the river as a result of more nutrient inputs. By removing this organic matter, the oysters helped reduce the negative effects of initial eutrophication. They also made this increased biomass available to their predators and other species higher in the food chain. The concept that shellfish and other filter feeding species had a key role in maintaining the biological stability of the Chesapeake estuary by

### Table 4.2

<table>
<thead>
<tr>
<th>Shell Height (mm/year) by River</th>
<th>1600-1760</th>
<th>1760-1860</th>
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<td>St. Mary’s</td>
<td>25.3</td>
<td>37.3</td>
<td>20.0</td>
<td>24.8</td>
</tr>
<tr>
<td>Patuxent</td>
<td>23.5</td>
<td>34.3</td>
<td>24.1</td>
<td>16.9</td>
</tr>
</tbody>
</table>

14 Ibid (Kirby and Miller)
15 Ibid (Kirby and Miller)
 preventing the accumulation of excess organic matter is well established.\textsuperscript{13,14}

Throughout prehistory, the colonial period and the early Federal era (c1800), the Chesapeake Bay had a biotic system in which the phytoplankton suspended in the water column were consumed in large part by suspension feeding species in the benthic environment. This prevented the accumulation of unused organic matter and kept bacterial activity at a reduced level. However, when the oyster populations were decimated in the later 19\textsuperscript{th} and early 20\textsuperscript{th}-century, this controlling element was severely degraded.\textsuperscript{16}

Research indicates that this led to a shift in the basic trophic structure of the Bay to bacterial consumption of accumulated organic material, leading to domination of the environment by microbes.\textsuperscript{17,18} These algae blooms became more common and potentially harmful to oysters. The microbial decomposition of the unused organic matter removes oxygen from the water column, leading to episodes of hypoxia.\textsuperscript{19,20} This shift to a bacteria-dominated ecology is directly related to degradation of estuaries.

The St. Mary’s oyster study is the first to demonstrate with data directly from the historic period of initial nutrient enrichment that shellfish were indeed responding by removing a portion of the greater biological production from the water, as reflected in their enhanced growth. But the fact that this growth did not continue, despite continual increases in the amount of nutrients entering the water and thus even more abundant food, points to other factors, especially the shift in trophic systems from plankton- and filter feeder-based to one dominated by bacteria. This indicates that the health of the Chesapeake is largely dependent upon the presence of huge numbers of filter feeders, especially the oyster.

Archaeology and history provide a valuable picture of the St. Mary’s River in previous centuries and the amazingly rich bounty it once offered. This summary is a very cursory review of a large quantity of evidence and research. The decline of biological productivity in the St. Mary’s River is very recent when compared to the long archaeological record. Reestablishment of a healthy benthic community, including SAV restoration, control of nutrient inputs, intensive repopulation of oysters and other filter feeders, and a moratorium on harvesting are appropriate steps for maintaining and even restoring the St. Mary’s River to some reflection of its past abundance. Unlike many estuaries, the St. Mary’s is not totally degraded and has great potential for restoration of lost productivity, especially in the form of the vital benthic filter feeders.

\textsuperscript{16} RIE Newell, "Ecological changes in Chesapeake Bay: are they the result of overharvesting the eastern oyster (Crassostrea virginica)?" Chesapeake Research Consortium 129 (1988): 536–546.
WATER QUALITY

OVERVIEW

In essence, the preservation and restoration of the water quality and aquatic ecosystems of the St. Mary’s River and its tributaries are the raison d’être for this watershed characterization. In this section we present an in depth review of water quality and the status of stream ecosystems the St. Mary’s River watershed.

We begin with an overview of the Clean Water Act of 1972, since this act provides the framework for conducting water quality assessments and for corrective measures when waters do not meet regulatory standards.

THE FEDERAL CLEAN WATER ACT, WATER QUALITY STANDARDS, AND DESIGNATED USES

The Clean Water Act is the primary federal law protecting our nation's lakes, rivers, and coastal areas. In establishing a comprehensive framework of standards required of states, municipalities, and industries, the Clean Water Act:

- requires municipalities and major industries to meet performance standards to ensure pollution control;
- charges states and tribes with setting specific water quality criteria appropriate for their waters and developing pollution control programs to meet them;
- provides funding to states and communities to help them meet their clean water infrastructure needs; and
- protects wetlands and other aquatic habitats through a permitting process that ensures development and other activities are conducted in an environmentally sound manner.

In accordance with these guidelines, all water bodies in Maryland are assigned a designated use, which is recorded in the Code of Maryland Regulations, COMAR 26.08.02.08.1. Waters in the St. Mary’s River watershed are categorized as Use I or Use II:

- Use I waters must be “swimmable and fishable,” being designated for water-contact recreation and protection of aquatic life.
- Where the St. Mary’s River becomes a tidal estuary, the water also must be safe for Use II, which includes shellfish harvesting.

The Clean Water Act (sections 303(d), 305(b) and 314) requires that states identify waters that do not meet the water quality standards for their designated uses. Accordingly, Maryland submits a biennial report describing the State’s efforts to monitor, assess, track, and restore its waters. These reports, the latest of which is the 2014 Draft Integrated Report of Surface Water Quality in Maryland, identify waters not supporting their designated use. These waters are listed as impaired under the Clean Water Act section 303(d) and, therefore, are included on the 303(d) list.

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Impaired waters are prioritized and, depending upon the severity of the problem, may require a Total Maximum Daily Load (TMDL), which is the maximum amount of pollutant a water body can receive and still meet water quality standards and designated uses. Information considered in prioritizing impaired waters’ restorative actions includes the severity of the problem, the threat to human health and to resources of high value, and the understanding of the causes and remedies.3

Impaired Waters in St. Mary’s River Watershed

St. Mary’s River and tributaries

- **Biological Impairment**: Sections of the first through fourth order streams in the non-tidal St. Mary’s River watershed have been identified as impaired for aquatic life and wildlife since 2002. The 2014 Draft Integrated Report4 lists approximately 29% of stream miles as impaired. The sources of impairment are still unknown. These streams are shown in Figure 1.

- **pH**: The tidal St. Mary’s River was first listed as impaired by low pH in the 2014 Draft Integrated Report,4 and requires a TMDL. Although it is suggested that low pH is a major stressor affecting the biotic community, it is a low priority for TMDL development. The source of this acidity has been attributed to atmospheric deposition. Due to the areas natural soil and geology, the ability of streams to neutralize this low acidity is reduced.5

- **Nutrients**: The tidal St. Mary’s River was identified as impaired by total nitrogen and phosphorus on the 1996 303(d) list.6 Due to 2008 changes in segmentation, this listed portion of the St. Mary’s River Basin is now included under the Lower Potomac River Mesohaline Chesapeake Bay Tidal Basin.7 The source of these nutrients was listed as agricultural but development of a TMDL is still low priority as of 2012. Seasonal deep water fish and shellfish and seasonal deep channel refuge use subcategories are still impacted.

- **Sediment**: The St. Mary’s River was identified as impaired by sediment on the 1996 303(d) list.8,9 The source of total suspended sediment is unknown. The designated use subcategory affected is seasonal shallow-water submerged aquatic vegetation. It is also a low priority for TMDL development.

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7 Matthew Rowe, MDE, Personal communication. December 2008 and January 2009.

8 ibid (MDE, TMDL homepage)

9 ibid (MDE, 2014)
USE IMPAIRMENTS (NON-SUPPORTING USES) continued

- **Bacteria Impairment:** Three streams designated for shellfish usage (now included in the Potomac River Mesohaline Chesapeake Bay tidal segment) have been impaired by fecal coliforms since 1996 — Locust Grove Cove, St. Inigoes Creek and Carthagena Creek.\(^{10,11}\)

  - In 2005, the Environmental Protection Agency approved a TMDL for fecal coliforms in restricted shellfish harvesting areas of the St. Mary’s River watershed. In accordance with the TMDL, Maryland Department of the Environment completed a Bacterial Source Tracking study, which found the primary sources were livestock, followed by wildlife, pets, failing septic systems and recreational vessels. To reduce fecal coliform levels, the TMDL suggested that Best Management Practices be implemented in the watershed. According to the 2012 Draft Integrated Report of Surface Water Quality in Maryland, “newer data shows that the shellfish bacteria standard is being met.”\(^{12}\) In the 2014 Draft Integrated Report, there was insufficient information in regards to if the TMDL was met.

- **PCB:** The tidal sub segment of the St. Mary’s River, categorized under the Potomac River Mesohaline Basin, was listed as impaired for fishing due to PCB found in fish tissue in the 2012 Integrated Report of Surface Water Quality In Maryland.\(^{13}\) As of the 2014 Draft Integrated Report, some areas in the tidal St. Mary’s River have met the PCB TMDL, but with insufficient information, the St. Mary’s River as a region is still listed as impaired.

  - **Mercury:** Tissue samples of fish taken from St. Mary’s Lake show high levels of methyl mercury due to atmospheric deposition and bioaccumulation of mercury over time.\(^{14}\) The lake remains impaired and has a TMDL (2012 Integrated Report of Surface Water Quality in Maryland). The source of the mercury pollution is atmospheric deposition from the emissions of power plants, municipal waste combustors, medical waste incinerators, cement plants and other industrial sources from within the watershed, as well as from outside Maryland and even the United States. The TMDL report lists a number of recent and ongoing initiatives within Maryland, ranging from voluntary to regulatory, that involve the phase-out of mercury usage, industrial handling of mercury-containing products and wastes, and consumer recycling of mercury containing products.

- **Nutrients and Low Dissolved Oxygen:** St. Mary’s Lake is listed in the 2012 Integrated Report as impaired for aquatic life and wildlife due to excessive phosphorus (total) and low dissolved oxygen. As of the 2014 Draft Integrated Report, some of areas in St. Mary’s Lake have met the TMDL, but overall do not meet the standard.

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\(^{12}\) Ibid (previous page, 2014 draft integrated report)

\(^{13}\) Ibid (MDE, Watershed report, previous page)

Figure 5-1. Biological Impairment assessment of the Non-Tidal St. Mary’s River Watershed, using benthic (BIBI) and fish (FIBI) indices of biotic integrity.  

Causes of Water Quality Impairment

Nutrients

In Maryland, most water bodies naturally have low levels of the nutrients nitrogen or phosphorus. These nutrients enter waterways from all types of land and from the atmosphere. Nutrient pollution or over-enrichment problems may arise from one place or from numerous sources. Point source pollution arises from a single traceable source, such as sewer outflows. Non-point source pollution comes from many sources in the watershed and is difficult to track. Residential land can contribute large amounts of non-point source pollution depending on fertilizer use, extent of lawn and the status of septic systems. Many farmers carefully manage nutrients using different approaches, so nutrient levels entering waterways from cropland vary greatly depending on management techniques. Acre for acre, smaller amounts of nutrients reach surface waters from forest land than from developed or agricultural land. The atmosphere can contribute various forms of nitrogen arising from the burning of fossil fuels in power plants and other industries, and from automobiles.

Suspended Sediment

Most unpolluted streams and tidal waters naturally have limited amounts of sediment moving or suspended in the water. Excessive amounts of suspended sediment in waterways are considered pollution because they can inhibit light penetration, prevent plant growth, smother fish eggs, clog fish gills, and cause other ecological damage. Sediment in streams tends to arise from stream bed and bank erosion and from land that is disturbed or poorly vegetated. Suspended sediment pollution may arise from construction sites, crop land, bare ground and exposed soil. Sediment pollution varies greatly from site to site depending upon stream stability, hydrology, and management controls.

Fecal Coliforms

The presence of fecal coliform bacteria indicates that fecal waste and other pathogenic bacteria may be present. Typically found in the digestive tract of mammals, fecal coliform bacteria are always found in animal waste and human sewage (unless it is treated to kill them). Water samples from unpolluted streams and tidal waters typically contain very few of these bacteria. Water samples exhibiting significantly larger fecal coliform bacteria populations are indicators of contamination by animal, including human; waste. Depending on local conditions, sources of fecal contamination may include any combination of the following: inadequately treated sewage, failing septic systems, wild or domestic animals, storm water carrying pet waste and similar sources.

Toxic Substances

A wide array of materials may be considered toxic substances because they exhibit poisonous or lethal effects or otherwise harm aquatic life. These materials are diverse in their sources and effects. Sometimes toxic substances can occur naturally, but toxic substances of concern for water quality restoration result from human activity. For regulatory purposes, the U.S. Environmental Protection Agency maintains a list of substances that are considered to be toxic. Examples include heavy metals, polychlorinated biphenyls (PCBs), asbestos and many other materials.
Fish Consumption

Many fish are safe to eat; however, some fish contain chemicals that may harm children and adults. The Maryland Department of the Environment (MDE) is responsible for determining how much of a given species caught in Maryland’s waters can be safely consumed.

Statewide advisories are present for the consumption of small and largemouth bass from all public waters, as well as all sunfish, including bluegill, from lakes and other impoundments. Saltwater fish are likely to contain significant levels of PCBs and mercury, and are a concern for child-bearing age women.

More information on state and federal fish consumption advisories can be found at http://www.mde.state.md.us/programs/marylander/citizensinfocenterhome/pages/citizensinfocenter/fishandshellfish/index.aspx.

Shellfish Harvesting Restrictions

Restrictions on shellfish harvesting affect certain regions of the St. Mary’s River watershed. MDE is responsible for regulating shellfish harvest. Many shellfish, including oysters and clams, sieve water through their gills in order to capture food. If the water is contaminated with pathogenic bacteria, the bacteria are also trapped. This could pose a possible health risk if contaminated shellfish are eaten. Risk of bacterial contamination increases following precipitation events, as sewer overflows and increased runoff from land containing animal waste are more likely.

Restricted areas are those in which no harvesting is allowed at any time. In conditionally approved areas, harvesting can occur except for the three days following a rain event of greater than one inch in a twenty-four hour period. Harvesting can occur at any time in areas designated as open or approved.

These areas are shown in Map 4 Designated Uses and Use Restrictions. Please visit the MDE’s Shellfish Harvesting Areas Web page for the most up-to-date information: http://www.mde.state.md.us/programs/Marylander/CitizensInfoCenterHome/Pages/CitizensInfoCenter/FishandShellfish/shellfish_advisory/default.aspx.

16 See page 5-15 for more information on filter feeders


18 Maryland Department of the Environment, “Conditionally Approved Shellfish Waters,” http://mde.maryland.gov/programs/Marylander/CitizensInfoCenterHome/Pages/citizensinfocenter/fishandshellfish/harvesting_notices/conditionalareas.aspx, Acc-
Nutrient Over-Enrichment and Eutrophication

The productivity of many lakes, estuaries, and coastal marine systems is limited by nutrient availability. The addition of nutrients to these systems increases the productivity of phytoplankton communities, which include the following photosynthetic, single celled organisms: algae, diatoms, dinoflagellates, cyanobacteria, and coccolithophores. These organisms are crucial for sustaining food webs as prey for various zooplankton, invertebrates, mammals, and fish. In moderation, nutrient enrichment can be beneficial, for example by increasing fishery stocks through increased prey (plankton) production. However, excessive nutrient enrichment can have myriad devastating effects, including eutrophication.

Eutrophication typically results in a rapid increase (or bloom) in phytoplankton populations. However, these blooms quickly consume all available nutrients, rapidly exceeding the carrying capacity. High phytoplankton mortality soon follows. As dead phytoplankton settle to the bottom of the water column they are broken down by bacteria, thus removing dissolved oxygen from the system during the decomposition process. This large reduction in oxygen is what causes dead zones, areas that have little oxygen (hypoxic) to no oxygen (anoxic). Dead zones are particularly devastating for sedentary, benthic organisms (such as shellfish). Crustaceans and fish can also be affected, depending on the scale and duration of the dead zone.

Eutrophication events also increase competition between phytoplankton of the same or different species, as changes in nutrients, sunlight, and dissolved oxygen favoring some species over others. Favored species are able to out-compete less favored species and results in shifts in phytoplankton community structure. This has implications for predator species as the shift in availability prey can alter predator growth, abundance, and distribution. Changes in planktonic communities also can affect

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Figure 5-2. Eutrophication in estuarine systems

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21 ibid
human health as some harmful algal blooms, also known as red or mahogany tides, can cause fish and shellfish kills and shellfish poisoning from high concentrations of algae-produced toxins, or even human rashes and illness from contact with affected waters. These factors as a whole contribute to a loss of biodiversity and ecological structure.

Plankton blooms also reduce the light available to submerged aquatic vegetation (SAV), as free-floating plankton and epiphytic plankton effectively shade out the leaves, reducing photosynthesis and causing mortality. SAV die-offs facilitate further environmental degradation in terms of water quality and clarity and a reduction in essential nursery habitat for juvenile crustaceans and fish.

Ceratium, a phytoplankton that causes mahogany tides in the Chesapeake. Photo credit: Dr. Chris Tanner

Thus far, Tier II waters are the highest quality identified in the state, and several have been identified in the St. Mary’s River watershed. Figure 4-3 shows the Tier II waters currently identified in the St. Mary’s River watershed. Figure 4-11 shows Tier II waters mapped in 2008. These include: St. Mary’s River 1, St. Mary’s River UT1(2008), St. Mary’s River UT2 (2008), Hilton Run, Johns Creek, and Warehouse Creek.

Figure 5-3. Tier II waters identified in St. Mary’s County. (From Maryland Department of the Environment, Maryland’s High Quality Waters (Tier II): Maps depicting Locations of High Quality Waters by County. http://www.mde.state.md.us/ResearchCenter/Data/waterQualityStandards/Antidegradation/index.asp. Accessed. January 2009.
In 1998, in compliance with the Clean Water Action Plan, Maryland completed a state-wide watershed assessment and an action plan for its “8-digit” watersheds, *Maryland Clean Water Action Plan Final 1998 Report on Unified Watershed Assessment*. This plan established priorities among the state’s 134 8-digit watersheds for restoration and protection. (St. Mary’s River is an 8-digit watershed.)

Because aquatic organisms are sensitive to changes in water quality, aquatic habitat, and the landscape, certain indicator species or indices that combine ecological factors were used in the *Unified Watershed Assessment*. As such they can be used to point to areas that might need further investigation, protection, or restorative actions.

Based on these indicators, the watersheds were classified according to the following categories:

- Priority Category 1 -- not meeting clean water or natural resource goals and in need of restoration;
- Priority Category 2 -- needing preventative actions to sustain water quality and aquatic life; or
- Select Category 3 -- needing protection to maintain pristine or high quality resources.

**Results:** It is important to note that these results are from 16 years ago.

Overall, the St. Mary's Watershed was classified as a Select Category 3, due to the presence of the following natural resources:

- A migratory fish spawning area
- Over 25% of headwater streams occurring in interior forests
- 67% of watershed forested
- 1,459 wild land acres (St. Mary's River, St. Mary's River State Park).

**However, the watershed also had four failing indicators,** which call to attention the need for possible remedial actions. The failed indicators were:

- Submerged Aquatic Vegetation (SAV) abundance
- SAV habitat
- Historic wetland loss (a landscape parameter), and
- Three occurrences on the 303(d) list of the Federal Water Pollution Control Act (clean water requirements).

While it is best to view the findings from the *1998 Watershed Assessment* in combination with other assessments of local conditions, the indicators used in the *Unified Watershed Assessment* are described in further detail in the following section.

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Unified Watershed Assessment Indicators and Findings

The following factors were scored on a range from 1 for most degraded to 10 for the best condition:

**Nontidal Benthic Index of Biotic Integrity:**
*Score: 7.43*

Insects, insect larvae, crayfish, and other creatures living on the bottoms of streams are essential to the functioning of aquatic ecosystems. Such benthic (bottom dwelling) organisms are particularly sensitive to changes in water quality and physical habitat. The Benthic Index of Biological Integrity (B-IBI) looks at the benthic community and considers the number and diversity of species and the presence of sensitive species.

The St. Mary's River watershed had a B-IBI of 7.43. Watersheds with a score of 6.0 or greater were classified as meeting restoration goals.

**Nontidal Fish Index of Biotic Integrity:**
*Score: 6.0*

Indexes of Biotic Integrity (IBIs) for fishes were developed for small (first- to third-order) non-tidal streams, as are found in the St. Mary's River watershed. A fish IBI score was calculated for each sampled stream from measured characteristics of the fish community -- the numbers of native species, benthic species, and tolerant individuals; the percent of tolerant species, dominant species, generalists, omnivores, and insectivores; the number of individuals per square meter; biomass in grams per square meter; percent of lithophilic spawners; and percent insectivores.

Scores were reported as means for the sites within each watershed, with scores of less than 6 representing a failed indicator. The St. Mary's watershed had a passing score of 6.

**Non-tidal In-stream Habitat:**
*Score: 4.75*

This physical habitat indicator, developed for small (first- to third-order) non-tidal streams, is based on measures that rate the quantity and quality of physical habitat available for fish and benthic macroinvertebrate colonization and the degree of alteration to the stream channel. Watersheds with scores in the lower 25% receive a Category 1 rating. Low or declining scores reflect both natural disturbances and human-induced alterations of the stream habitat. The indicator as applied to Coastal Plain streams includes five characteristics: in-stream habitat structure, velocity-depth diversity, pool quality, riffle quality, and aesthetic quality.

The score of 4.75 given the St. Mary's River watershed suggests natural or human-induced alteration in the stream habitat, but the 1998 Watershed Assessment does not provide basin-specific information; one could surmise that aspects of these 5 characters may have been influenced by land use and land-cover patterns in the watershed, such as the destruction of riparian forests, an increase in impervious land cover, channelization, encroachment by livestock, and blockages to fish movement. Understanding the specific factors could point towards the appropriate corrective actions.

**Migratory Fish Spawning Area:**
*Score: 1.0*

This indicator -- used in the 1998 Watershed Assessment to identify watersheds that are candidates for conservation and protection -- rates watersheds based on the diversity of spawning habitat for American Shad, Hickory Shad, Alewife, Blueback Herring, White Perch, Striped Bass, and Yellow Perch.

St. Mary’s was given a score of 1, indicating the presence of one migratory fish, the Yellow Perch. This indicator reflects vulnerability to human-induced damage and the condition of the resource, such as physical blockages from dams and road culverts or water quality impairment, or a combinations of these factors.
A large amount of water quality and related data has been collected in the St. Mary’s River watershed for over a decade.

The Maryland Biological Stream Survey (MBSS) of the Maryland Department of Natural Resources has been charged with sampling non-tidal wade-able streams to determine whether freshwater streams are meeting their designated uses under the Clean Water Act. Since 1994, the MBSS has collected data on fish and benthic macroinvertebrate populations in streams, both of which serve as indicators of water quality for aquatic life. They also collect water chemistry and physical habitat data. Using this information, stream segments are rated as good, fair, poor or very poor, with ratings of poor and very poor being impaired (See Table 4-1 for local stream ratings and Map 6 for site locations).

In 2000, the Department of Natural Resources also initiated Maryland Stream Waders, a program that involved volunteers in collecting benthic macro invertebrate samples in the spring. Stream Wader volunteers sampled streams in the St. Mary’s River watershed in 2000 and nearly every year since 2003 (See Map 7 for sampling locations). Their results have supplemented MBSS surveys in determining the area’s water quality.

Additionally, in 1999, the St. Mary’s River Project began collecting water quality data from approximately 25 tidal and non-tidal stations in the area. A stream corridor assessment and tidal shoreline survey was conducted in 2008 by St. Mary’s College of Maryland with support from DNR, NOAA, and SMRWA. The assessment identified several potential problem sites and recorded basic habitat information. St. Mary’s College of Maryland also completed a synoptic survey in 2008 which included water quality monitoring and nutrient analysis. Data collected by the St. Mary’s River Project is summarized in another report, St. Mary’s River Water Quality Assessment, and discussed later in this section.

Three shore stations monitored by citizens were established by the Alliance for the Chesapeake Bay and St. Mary’s College of Maryland in 1997 in the tidal St.

Mary’s River to determine the feasibility of restoring species of SAV.29

Several other agencies collect water quality and quantity data. A U.S. Geological Survey gaging station in the St. Mary’s River has collected data annually since 1946, with the exception of 2006.30 The U.S. Army Corps of Engineers and Maryland DNR have conducted studies in the watershed.31 The Maryland Department of the Environment collects fecal coliform and other limited water quality data due to concern over commercial shellfish harvests.32

The St. Mary’s County Health Department performs bacterial water quality monitoring from Memorial Day to Labor Day at various beaches throughout the county. Within the St. Mary’s River watershed, the county monitors Sanner’s Lake.33

The following pages provide detailed findings from these various studies.

April 22, 2008—Dr. Bob Paul sampling for benthic invertebrates with a D-net in an upper tributary to the St. Mary’s River. Photo credit: Bob Lewis, St. Mary’s River Watershed Association.

30 Ibid.
31 Ibid.
32 Ibid.
Table 5-1. Water Quality Monitoring From the Maryland Biological Stream Survey: These data from the Maryland Department of Natural Resources includes spring and summer surveys at sites on streams in the St. Mary’s watershed from 1995-2011. Column 1 gives the year in which the sampling occurred. The water quality score is determined by averaging the scores for the Benthic Index of Biological Integrity (IBI) and the Fish IBI. The water quality rating determined from the final IBI score is used by the Maryland Department of the Environment to determine whether a water body is meeting its designated use for aquatic life.

<table>
<thead>
<tr>
<th>Site # -Year Sampled</th>
<th>Stream</th>
<th>Benthic IBI Score (Rounded)</th>
<th>Fish IBI Score (Rounded)</th>
<th>Final IBI Score (Rounded)</th>
<th>Rating</th>
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</tr>
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St. Mary’s College with support from DNR, NOAA and SMRWA prepared a report that reviewed the 10 years of data collected in the St. Mary’s River Watershed though the St. Mary’s River Project (1999-2009). A brief summary of the findings follows.34

**Non-tidal Portion Results**

**Dissolved Oxygen**

Dissolved oxygen levels below 5 mg/L in surface waters indicate insufficient oxygen to support aquatic life. Dissolved oxygen levels in the non-tidal portions of the St. Mary’s River watershed were consistently high in the last 10 years of data collected.

**Nutrients**

Nutrients were typically low with the following exceptions, where nutrient levels were higher:

- The Locust Grove Cove site — data suggest that nutrients are primarily from organic sources.
- The tributary from the St. Andrew's Church Landfill. The surrounding area is experiencing increased urbanization. Nutrient levels are lower further downstream.
- The Hickory Hills tributary — higher nutrient levels could be due to runoff and land development. It is suspected that heavy precipitation plays a large role in transporting nutrients into St. Mary’s River tributaries.

**Total Suspended Solids**

Generally, values for Total Suspended Solids, a measure for sediments and other particles in the water, were relatively low (<20 mg/L). Noteworthy findings follow.

- Variability was closely tied to precipitation, and was most noticeable in Pembrook Run, Fisherman’s Creek, and Church Creek.
- The Church Creek site was observed to have poor stormwater controls and high discharges that lead to erosion.
- High levels of sediment in St. Indigoes Creek have been noted by nearby residents.

**Alkalinity, pH and Dissolved Organic Carbon**

Alkalinity and acidity (pH) in the St. Mary’s River watershed are similar to levels in other coastal plain areas. Alkalinity is generally low, less than 50 mg/L of CaCO₃, and pH levels are generally between 6.5 and 7 standard units. Overall, dissolved organic carbon levels were low, less than 10 mg/L, with the exception of the tidally-influenced site at Locust Grove Cove.

**Temperature**

Healthy temperature levels for aquatic life are typically below 30°C. Temperatures of the non-tidal sites averaged 25°C, and followed a seasonal pattern. Temperatures of St. Mary’s Lake were

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higher overall due to surface warming, and the sample site downstream of the lake release also had higher temperatures. In addition, the tidally influenced Locust Grove site had higher temperature levels.

**Tidal Portion Results**

Much of the variability in tidal results seems to be driven by seasonal weather patterns, precipitation, algal growth and decay, and oxygen profiles in the water column.

**Dissolved Oxygen**

- Low oxygen levels have been found at the deeper sites of St. Mary’s River every summer from 2000-2009.
- Tidal creek stations also showed low oxygen levels, although not as severe as the main channel of the river.
- It is believed that this low oxygen is related to nutrient enrichment in the spring from runoff, fueling algal blooms. Subsequent dieoffs of algae reduce oxygen levels during decomposition.

**Nutrients**

- Nitrogen concentrations were quite variable, but were typically low.
- Tidal stations located furthest upstream, closest to freshwater sources, generally had the highest nitrogen and phosphorus levels.

**Total Suspended Solids**

For Use I waters Maryland water quality standards state that sediment loads should not be greater than 150 mg/l at any one time, or 50 mg/l as a monthly average. Concentrations of 15 mg/l or greater generally inhibit growth of submerged aquatic plants, because light can not penetrate to the plants’ leaves.

- Levels ranged between less than 5 mg/L to nearly 100 mg/L. They were varied between stations and sampling periods.
- Levels for Total Suspended Solids were highest in the spring and summer and were linked to precipitation.
- Higher levels were sometimes recorded after storm events.

**Chlorophyll**

Measurements of the amount of chlorophyll in the water are used to assess the amount of phytoplankton in the water column. Phytoplankton blooms are stimulated by a combination of factors, including high nutrient levels and light availability. They can be linked to low oxygen levels and fish kills.

- The chlorophyll threshold is exceeded most years.
- High chlorophyll and algal concentrations likely contributed to decreased oxygen levels in the bottom waters of the St. Mary's River and its tributaries.

**pH**

The sites located farthest up-river tended to display the lowest pH values and the most variation. Likely, this is because these sites are more directly affected by activities on land and are farther from the stabilizing effects of tidal flushing from oceanic waters.

**Salinity**

Generally, the tidal portion of St. Mary’s River is of moderate salinity (a partially-mixed mesohaline estuary) with salinities between 10
and 20 ppt. Salinity showed an annual cycle with highest levels in the fall and early winter and lowest levels in late spring and summer due to increased rainfall.

**Temperature**

Water temperature showed pronounced seasonal variation at all tidal stations. For most of the year the water column was partially mixed, but distinct temperature and/or salinity layers were observed, indicating that the river can become highly stratified.

**Table 5-2. Index of Biological Integrity Scores for Sampling Stations.** IBI scores were computed yearly for all SMRP stations, using the MBSS method. Taken as a whole, they show that more than half of the streams provide good water quality. At the other end of the spectrum, three sites might be in need of remedial attention: Landfill Tributary (NT05) had a score bordering "poor," and Hickory Hills and Church Creek both had "poor" scores.

<table>
<thead>
<tr>
<th>Station Number</th>
<th>Site Name</th>
<th>SMRP IBI's</th>
<th>MBSS IBI's</th>
</tr>
</thead>
<tbody>
<tr>
<td>NT02</td>
<td>Warehouse Run</td>
<td>4.25</td>
<td>4.75</td>
</tr>
<tr>
<td>NT03</td>
<td>Below SM Lake</td>
<td>4.00</td>
<td>-</td>
</tr>
<tr>
<td>NT05</td>
<td>Landfill Trib</td>
<td>-</td>
<td>4.25</td>
</tr>
<tr>
<td>NT06</td>
<td>Hickory Hills</td>
<td>3.50</td>
<td>-</td>
</tr>
<tr>
<td>NT07</td>
<td>Norris Road</td>
<td>3.50</td>
<td>-</td>
</tr>
<tr>
<td>NT08</td>
<td>Jarboesville Run</td>
<td>4.25</td>
<td>-</td>
</tr>
<tr>
<td>NT09</td>
<td>US Gaging Station</td>
<td>3.75</td>
<td>-</td>
</tr>
<tr>
<td>NT09.5</td>
<td>Johns Creek</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NT10</td>
<td>Hilton Run</td>
<td>4.25</td>
<td>-</td>
</tr>
<tr>
<td>NT11</td>
<td>Pembroke Run</td>
<td>4.25</td>
<td>4.00</td>
</tr>
<tr>
<td>NT12</td>
<td>Eastern Branch</td>
<td>4.50</td>
<td>-</td>
</tr>
<tr>
<td>NT13</td>
<td>Fisherman's Creek</td>
<td>2.75</td>
<td>3.50</td>
</tr>
<tr>
<td>NT14</td>
<td>Church Creek</td>
<td>-</td>
<td>3.50</td>
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</tbody>
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Lower Potomac River Tributary Strategy Program

“In the Early 1990’s, the Chesapeake Bay partners recognized that restoration efforts must extend into the Tributaries of the Bay watershed in order to reach the goal of a restored Bay. Maryland answered this challenge by establishing Tributary Strategy Teams in 1995. The Teams provided a venue for a broader group of stakeholders to participate in restoration efforts and to advocate for solutions especially at the State and local levels. Approximately 300 volunteers were initially appointed to the Teams and many more people participated in the events, programs, trainings and field trips held by the Teams throughout the next 16 years. The mission of the Maryland Tributary Strategy Teams was to build consensus and advocate for policy solutions, to promote stewardship through education, and to coordinate activities and projects necessary to protect and restore the Chesapeake Bay’s water quality and assure healthy watersheds with abundant and diverse living resources.”


Ten tributary teams involving local citizens, farmers, business leaders and government officials focused on policy, legislation, implementation, and education. The St. Mary’s River watershed is one of eleven smaller watersheds within the Lower Potomac River tributary team.

The Lower Potomac River tributary team reported that the largest sources of excess nutrients in the Lower Potomac River basin are nonpoint sources from urban and agriculture runoff and from point sources. Although the use of agricultural best management practices (BMPs) and point-source reductions have lowered nutrient loads, nitrogen loading from septic systems increased by 23% from 1985 to 2000.

In 2003, the Chesapeake Bay Program developed nutrient caps (nitrogen and phosphorus) for the Lower Potomac River basin. To meet these caps, nutrient reductions are needed.

The Maryland Tributary Strategy Lower Potomac River Basin Summary Report for 1985-2005 Data modeled nitrogen, phosphorus, and sediment loadings. They found that sediment loads have decreased from 1985 to 2005. Notable findings are detailed below:

- Total nitrogen loadings were down 0.14 million pounds per year, 11% of Tributary Strategy goal.
- Total phosphorus loadings were down 0.12 million pounds, 74% of Tributary Strategy goal.
- Sediment loadings were down 31,000 tons per year, 54% of Tributary Strategy goal.

Following 2010, Tributary Strategy Teams in the Chesapeake Bay were largely replaced by...
Lower Potomac River Tributary Team

local watershed associations, with their restoration actions guided by Watershed Implementation Plans (WIPs). WIPs will be referenced in the Conservation and Restoration Targeting section, later in this document.

![St. Mary’s River Water Quality Maps]

Lower Potomac River Tributary Team continued

Figure 5-5. St. Mary’s River: August 24, 2005 Water Quality Mapping Highlights http://mddnr.chesapeakebay.net/sim/dataflow_data.cfm#stmary (Taken from Maryland Tributary Strategy Lower Potomac River Basin Summary Report for 1985-2005 Data with permission).

Figure 5-6. St. Mary’s River: November 2, 2005 Water Quality Mapping Highlights http://mddnr.chesapeakebay.net/sim/dataflow_data.cfm#stmary (Taken from Maryland Tributary Strategy Lower Potomac River Basin Summary Report for 1985-2005 Data with permission).
Point Source Discharge

Discharges from a single identifiable source, such as a pipe or other discrete conveyances are called point sources. This includes discharges from waste water treatment plants and industrial sources. Point sources may contribute pollution to surface water or to groundwater. Identifying point source discharges in a watershed can be useful in potential restoration measures. There are no major wastewater treatment plants with discharges in the watershed. A small wastewater treatment plant operates at the Navy’s Webster Field and it discharges into the St. Mary’s River. In 2013-2014, the Navy upgraded this plant to further reduce nitrogen and phosphorus to current industry levels.

There are currently 10 facilities that discharge into the St. Mary’s River watershed permitted under the National Pollutant Discharge Elimination System (NPDES) by the Maryland Department of the Environment.\(^ {38}\) There are 24 general stormwater and groundwater discharge permits in the watershed. A summary of this information is present in Table 4-3 and on Map 8.

In addition, MDE permitted approximately 28 stormwater discharge permits associated with construction in St. Mary’s County during 2008 and the beginning of 2009.\(^ {39}\) At least three of these are in the St. Mary’s River watershed. Information on permits can be obtained from MDE’s Environmental Permits Service Center (EPSC) or Water Management Administration.

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Table 5-3. Groundwater discharge, surface water discharge and other general permits, except those associated with construction, in the St. Mary’s River Watershed. From the Maryland Department of Environment Permit Tracking System (PERTs) database, January 2009.29

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>City</th>
<th>Permit</th>
<th>Permit Type</th>
<th>Permit Number</th>
<th>NPDES Number</th>
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<td>Groundwater Industrial Discharge</td>
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<td>California Mobile Home Park</td>
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<td>Hydrostatic Test</td>
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<td>Cool &amp; Garrett Park Water Supply System</td>
<td>Park Hall</td>
<td>General</td>
<td>Hydrostatic Test</td>
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<td>Langley Mobile Home Park</td>
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<td>Lord Calvert Trailer Park</td>
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<td>Saint Mary’s River State Park Whp &amp; Distribution System</td>
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<td>Saint Mary’s Visitors Center Whp</td>
<td>Lexington Park</td>
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<td>Hydrostatic Test</td>
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<td>And Pit</td>
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<td>General</td>
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<td>Champion Used Auto Parts, Llc</td>
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<td>General</td>
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<td>Knott Land Clearing Debris Landfill 2818</td>
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<td>Industrial Stormwater</td>
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<td>St. Mary’s County Airport</td>
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<td>St. Inigoes</td>
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<td>MDG499728</td>
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<td>Robert Lummloke, T/A Golden Eye Seafood</td>
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<td>06DP222</td>
<td>MD0063843</td>
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<tr>
<td>U.S. Naval Air Station Patuxent River-Webster Field Annex</td>
<td>St. Inigoes</td>
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<td>Surface Municipal Discharge</td>
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<td>Discharge</td>
<td>Surface Municipal Discharge</td>
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<td>Swimming Pool</td>
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<td>MD0766006</td>
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<td>St. Mary’s Yachting Center</td>
<td>Drawers</td>
<td>General</td>
<td>Swimming Pool</td>
<td>07SW0017</td>
<td>MD0766012</td>
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</tbody>
</table>
Nonpoint Sources

Nonpoint sources are significant contributors of pollutants, particularly nutrients and sediments. This pollution comes from many diffuse sources. This includes rain water that runs off roofs, streets and parking lots, as well as runoff from farm fields, yards and to a lesser extent forests. Atmospheric deposition and contributions from groundwater, where septic systems are a factor, are also considered nonpoint source pollution.

Nonpoint source pollution is a potential problem in the St. Mary's River watershed. Storm events have a major impact on the river and streams by carrying sediments and nutrients downstream and into the tidal river. Several sources of nonpoint source pollution are identified in the Lower Potomac River basin summary and are listed below:

- urban – from industrial, residential, institutional, mining and open urban lands
- septic – onsite wastewater treatment/disposal
- agriculture – from row crop, hay, pasture, manure
- forest – from forested lands
- mixed open – from non-agricultural grasslands including right-of-ways and some golf courses
- atmospheric deposition to water – deposited from the atmosphere directly to water

The majority of nutrients and sediments in the Lower Potomac River basin are from agriculture. The percentage of nutrients and sediments entering the basin were identified in the Maryland Tributary Strategy Lower Potomac River Basin Summary Report for 1985-2005 Data and are shown in the graphics to the right. Additional studies have cited increased development as a concern in the St. Mary’s River watershed.

Figure 5-7. The 2005 Nitrogen, Phosphorus, and Sediment Contribution to the Lower Potomac River Basin by Source Data from 2005 'Progress' Watershed Model 4.3 Delivered Loads, Chesapeake Bay Program 11-30-06 http://www.chesapeakebay.net/data/index.htm. (Taken from Maryland Tributary Strategy Lower Potomac River Basin Summary Report for 1985-2005 Data)

Shoreline Erosion

Wherever land and open water meet, change in the form of erosion or accretion of land is typically the inevitable result of natural processes. Human activity in these areas either tends to inadvertently accentuate these natural processes or purposefully attempts to control movement of water and/or loss of land. Erosion of shorelines can contribute significant amounts of nutrients (mostly phosphorus) and sediment (water column turbidity, habitat loss).

Countywide shoreline erosion is summarized in the following table.41

<table>
<thead>
<tr>
<th>Total Shoreline</th>
<th>Total Eroding Shoreline</th>
<th>Erosion Rate</th>
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</thead>
<tbody>
<tr>
<td>297</td>
<td>87 (29%)</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17</td>
</tr>
</tbody>
</table>

Maps of historic shoreline change were produced in 1999 by the Maryland Geological Survey (MGS) in a cooperative effort between DNR and the National Oceanic and Atmospheric Administration (NOAA). These maps included digitized shorelines for several different years in St. Mary’s County. The maps show the most change to shorelines adjacent to large bodies of open water. Copies of these 1:24000 scale maps are available from the MGS.

A tidal shoreline survey was conducted by St. Mary’s College in 2008. Several areas of shoreline erosion were identified are shown in Figure 4-8.

Figure 5-8. Tidal shoreline of the St. Mary’s River with an assessment of shoreline stability. Green markers indicate stable shoreline, red markers show shoreline erosion sites, and yellow markers show shoreline segments without corresponding geo-referenced photographs of the shoreline. (From St. Mary’s River Stream Corridor Assessment and Tidal Shoreline Survey.42)

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Impact of the Potomac River

The mouth of the St. Mary’s River empties into the Potomac River, a river that is more negatively impacted than the cleaner St. Mary’s. Because of the tidal nature of this system, the Potomac River does have an impact on St. Mary’s River water quality. Policy-makers often cite the Potomac River as the largest contributor to St. Mary’s River’s pollution.

In his senior thesis (2011), St. Mary’s College of Maryland student Michael Kushner, set out to determine just how much and to what extent the Potomac River impacted the St. Mary’s River. He set up a box model and took water quality readings from several sites throughout the tidal river. His results indicated that, as far as turbidity and pollutants, the Potomac River had negligible impact on the upper St. Mary’s River above Church Point. Impacts on the middle river above Chancellor’s Point were minimal. And from Chancellor’s Point southward to the mouth the impact gained in significance. While this study lacked scientific rigor necessary to formally document the findings, it did provide enough data to make a strong argument for further study.

Confluence of St Mary’s and Potomac Rivers. Photo courtesy Google, February 2016.
Long-term changes in the relative abundances and diversity of organisms often reflect changes in the health of the ecosystem, with declines typically resulting in reduced productivity and stability. Monitoring human impacts on water quality and population dynamics informs the implementation of effective preservation and restoration strategies. Species that are addressed in this document are those that have considerable ecological and/or economic value.

**Submerged Aquatic Vegetation**
Submerged aquatic vegetation (SAV) performs critical ecological functions such as providing nursery grounds and habitat for numerous species of aquatic animals and food for waterfowl. Additionally, the presence of SAV meadows improves water quality by trapping suspended sediment particles and absorbing dissolved nutrients. SAV acreage in the lower Potomac has been negatively correlated with nitrogen concentration.\(^2\) SAV is also an important indicator of water quality as populations decline or expand in response to changes in water clarity (suspended particles) and to changes in nutrient loads.

**SAV Status**
SAV increased dramatically in the tidal St. Mary’s River from no SAV as recently as 1994 to a high of 1,332 acres in 2002 (data from quadrangles 80 and 89 Virginia Institute of Marine Science aerial surveys, http://www.vims.edu/research/topics/sav/index.php).

The primary species in the tidal St. Mary’s River is widgeon grass (*Ruppia maritima*) with some eelgrass (*Zostera marina*) on the inside of St. Georges Island as the result of SAV restoration projects. In addition, horned pondweed (*Zannichellia palustris*) can be found in the spring and early summer, primarily in the upper tidal St. Mary’s River.

**SAV Restoration**
The Chesapeake Bay Program’s “Strategy to Accelerate the Protection and Restoration of Submerged Aquatic Vegetation in the Chesapeake Bay” set a goal of increasing the SAV acreage in the Bay to 185,000 acres by 2010. The acreage of SAV mapped in the bay in 2010 was 79,675 acres, 43% of the goal.\(^3\) The goal was to be met by improving water clarity, protecting existing SAV beds and planting 1,000 acres of SAV. The SAV acreage goal for the lower mesohaline Potomac River, which the St. Mary’s River is part of, was set at 10,173 acres.

Although the SAV goal for the St. Mary’s River is not available, there were 1,072 acres of SAV in the St. Mary’s River in 1952, a year that was used to determine SAV goals based upon extensive SAV acreage that year. In 2002 and 2003 the SAV acreage exceeded the 1952 acreage, but since then it has declined to about 24% of the 1952 level (2011). (Fig. 7; data for 2012 are not yet available) In 2011, 69% of the SAV acreage found in the lower Potomac was located in the St. Mary’s River.

The lower St. Mary’s River was identified as

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an area that met the habitat conditions suitable for SAV\textsuperscript{4,5} but lacked seeds, or propagules, for some species that were historically found in the river. In particular, eelgrass was once abundant at the mouth of the St. Mary’s River and in the lower Potomac.\textsuperscript{6} The lower St. Mary’s River and the adjacent Piney Point were selected for several eelgrass restoration projects based on evaluations of water quality, sediments characteristics, historic SAV distribution, location of hydraulic

![Graph showing SAV area from 1989 through 2011 in the lower Potomac River.](image)

**Figure 6-1.** The area of submerged aquatic vegetation from 1989 through 2011 in the lower Potomac River. The contribution of the St. Mary’s River are shown in red (quadrangles 80 and 89, Virginia Institute of Marine Science aerial surveys, http://www.vims.edu/research/topics/sav/index.php). Although the SAV goal for the St. Mary’s River is not available, the SAV area in the St. Mary’s River for 1952 (the year that the goals for the lower Potomac are based) was 1,072 acres (dotted line). Data are incomplete for the lower Potomac in 2003 (*).


clam dredging, and the success of preliminary test plantings.\textsuperscript{7,8}

Organizations that have sponsored SAV restoration projects in the tidal St. Mary’s include Maryland Department of Natural Resources (MD DNR; \url{http://www.dnr.state.md.us/bay/sav/restoration/pot_gen_info.asp}), Woodrow Wilson Bridge Project\textsuperscript{9}, Alliance for the Chesapeake Bay\textsuperscript{10}, and the St. Mary’s River Project\textsuperscript{11} with over 25 acres planted.

Eelgrass restoration in the St. Mary’s River has had limited success with the plants generally not surviving beyond two years. The best results have been along the northeast side of St. George Island, within St. George Creek, where plantings by MD DNR survived for more than four years.

Possible reasons for the limited success in restoring eelgrass in the St. Mary’s River include years with than higher than average precipitation and/or temperatures. Eelgrass becomes stressed at lower salinities (salinity less than 10) and high temperatures (water temperatures greater than 30° C, or 86° F). Low salinities in 2003 and 2004, high temperatures combined with low dissolved oxygen in 2005 and 2006, and high summer epiphyte loads are suspected as the cause of eelgrass mortalities at restoration sites in the lower St. Mary’s.\textsuperscript{12}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{SAV_coverage.png}
\caption{SAV in the St. Mary’s River north from Cherryfield Point (Quadrangle 80, VIMS aerial surveys, \url{http://www.vims.edu/research/topics/sav/index.php}).}
\end{figure}


\textsuperscript{10}Alliance for the Chesapeake Bay, “Estuarine Habitat Restoration,” \url{https://allianceforthebay.org/restoration-monitoring/estuarine-habitat-restoration/} (accessed 12 February 2016)

LIVING RESOURCE INDICATORS, continued

Crabs and Fish

1. Tidal Areas

Commercial fisheries harvest information—considered an indicator of the health of an aquatic system—is tracked by Maryland Department of Natural Resources (DNR) Fisheries Service. The following information on crab and striped bass in the St. Mary’s River watershed was obtained from the MD DNR Commercial Fisheries Annual Landing Data Set.10

Crab

The commercial crab catch for the St. Mary’s River is combined with that from other tidal Potomac River tributaries. These data are available from 1965 through 2008, with minimums experienced in 1972 at 55,600 pounds of crab harvested and a maximum of 2.82 million pounds in 1989. According to DNR data, 1,272,373 pounds of hard and soft-shelled crab were harvested in the Potomac tributaries in 2008, approximately 46,000 pounds increase from the previous year, but not considerably different from the 2004-2006 harvests. It is likely the St. Mary’s River crab fishery reflects the state of the overall Chesapeake Bay blue crab population, which has been in a period of low recruitment since 1997-1998, and continues to fluctuate annually.

The 2014 Chesapeake Bay Blue Crab Advisory Report11 is an assessment of blue crab stocks, based on the annual Chesapeake Bay Winter Dredge Survey and commercial harvest data, and provides recommendations for the blue crab fishery. Management efforts largely concentrate on adult female populations in the bay, with a target of 215 million crabs to maintain a sustainable fishery and a threshold of 70 million to avoid over-exploitation. Stocks are currently depleted but have not been listed as overfished, even though adult female crab abundances were estimated at 68.5 million crabs during the beginning of the 2014 crabbing season.

Additionally, this report makes recommendations for harvest reductions and continued monitoring of male crab abundance by jurisdiction.

Striped Bass

The last year reported for striped bass commercial fishery in the St. Mary’s River by the DNR Fisheries web site was 2002, when the harvest had fallen to 15,486 pounds, down from an average of 21,609 for the previous three years.

The striped bass stocks, which were depleted in the 1980’s, increased until 2003, and have subsequently experienced a decline to a level just above the threshold for over-exploitation. According to the 2013 Update of the Striped Bass Stock Assessment12 which used data from 2012, Atlantic striped bass are not overfished, even though adult female striped bass have been in decline since 2004.


2. Nontidal Areas

Data has been gathered about nontidal fishes in the St. Mary's River Watershed at 13 to 15 monitoring stations (Table 5-1 and Figure 5-3) since 1999 by the following three monitoring efforts:

- The Maryland Department of Natural Resources (DNR) surveyed the St. Mary's River watershed in 1995-1997 during the Maryland Biological Stream Survey (MBSS). This data is available through the MD DNR interactive maps (http://www.dnr.state.md.us/streams/maps.asp).
- The St. Mary's River Project (SMRP) has sampled for fish during the MBSS Summer Index Period since 1999. Although the number of stations sampled by SMRP has not been consistent, nearly all stations were collected from in 1999, 2001, and 2008. Table 7 displays fish species and numbers collected by year and sampling station.
- As part of the 2008 watershed synoptic survey conducted by Dr. Robert Paul of St. Mary's College of Maryland, fish sampling was conducted in July 2008 following MBSS protocols.

The SMRP and synoptic survey data showed that from 1999 to 2008, a total of 4333 individual fish were captured and released -- representing 11 families and 41 species (data available in Table 5-2). Of this total, 92 fishes were collected in 2008, representing 10 families and 26 species. Data from the years 1999 and 2001 (when samples were conducted at most stations) showed that 4 species represented nearly 80% of the fish collected. The MBSS study had slightly different results, showing that 6 species comprised 75% of the total captured. While differences among the SMRP and MBSS samples existed, both agreed that the dominant species in the watershed were: eastern mudminnow, least brook lamprey, American eel, and tessellated darter.

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<th>Non-tidal Stations</th>
<th>Station ID</th>
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<th>Longitude (DD MM.MMMM)</th>
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<td>Jarboesville Run</td>
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<td>USGS Gaging Station</td>
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<td>Church Creek</td>
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Figure 6-3. St. Mary’s River watershed showing the tidal and non-tidal sampling stations used in the St. Mary’s River Project (Courtesy of R. Paul and C. Tanner).
The following noteworthy points can be surmised from the different surveys:

Fisherman's Creek (NT13) had less fish diversity than other sites, likely due to poorer habitat conditions. Most sites had at least 9 fish species and 100 individuals in 1999, whereas the 75-m section of Fisherman Creek has only 4 species. The number increased to 8 in 2005, then back down to 6 in 2008.

Hickory Hills (NT06) and Jarboesville Run (NT08) fish communities are declining in numbers and diversity. It is probable that urbanization in these subwatersheds has detrimentally affected the habitat and resources.

The 2008 survey pointed to problems at Norris Road (NT07) and Hilton Run (NT10). Norris Road has rather poor fish habitat, but the results from Hilton Run were surprising in that previous samples had good fish diversity, according to the Index of Biological Integrity (IBI) scores.

Largemouth bass represented an anomaly: For all creeks in 1999, none were collected; in 2001, 10 were captured; in 2008, 4 were counted.

A large decrease was seen in the percentage of least brook lampreys from the SMRP surveys. In 1999, they represented 19% of all fish; in 2008, they were only 5.6% of the sample. It is possible, however, that the large decline was related to sampling efficiency, rather than stream habitat change.

Incorrect field identification may account for 3 rare species in the SMRP samples (Bridled shiner, Warmouth, and Satin fin shiner).

Diagram of the Maryland Darter. Adapted from the Maryland DNR Maryland Darter poster: dnr2.maryland.gov/strems/Publications/MDDarterID.pdf

| Genus Species                      | Common Name         | NT 02 | NT 03 | NT 05 | NT 08 | 1999 | 2000 | 2001 | 2003 | 2005 | 2008 | 1999 | 2000 | 2001 | 2003 | 2005 | 2008 |
|-----------------------------------|---------------------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| *Petromyzontidae*                |                     |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Lampetra camtschatica            | Least Brook Lamprey| 106   | 42    | 43    | 24    | 7    | 1    | 0    | 41   | 24   | 7    | 2    | 44   | 13   | 60   | 2    |      |      |
| *Petromyzon marinus*             | Sea Lamprey         | 0     | 0     | 0     | 0     | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 4    | 2    | 0    | 0    |      |      |
| *Anguillidae*                    |                     |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Anguilla rostrata                | American Eel        | 87    | 36    | 25    | 30    | 21   | 138  | 13   | 11   | 4    | 6    | 7    | 7    | 49   | 22   | 20   | 11   |      |
| *Ictaluridae*                    |                     |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Amietus melas                    | Black Bullhead      | 0     | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |      |
| Amietus nebulosus                | Brown Bullhead      | 0     | 1     | 0     | 3     | 0    | 0    | 7    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |      |
| Noturus gymsus                   | Tadpole Madtom      | 18    | 4     | 5     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 3    | 0    | 1    | 1    |      |
| Noturus insignis                 | Margined Madtom     | 0     | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 7    | 3    | 0    | 0    |      |
| *Esocidae*                       |                     |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Esox niger                       | Chain Pickerel      | 1     | 1     | 1     | 1     | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 10   | 2    | 0    | 0    |      |
| *Aphredoderidae*                 |                     |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Aphredoderus sayanus             | Pikes Perch         | 25    | 6     | 8     | 0     | 7    | 0    | 0    | 10   | 0    | 0    | 1    | 0    | 20   | 2    | 4    | 0    |      |
| *Umbridae*                       |                     |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Umbra pygmaea                    | Eastern Mudminnow   | 5     | 9     | 12    | 37    | 6    | 0    | 0    | 15   | 13   | 5    | 1    | 0    | 15   | 13   | 21   | 1    |      |
| *Cyprinidae*                     |                     |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Cyprinella spiloptera            | Spotted Shiner      | 0     | 0     | 0     | 0     | 0    | 0    | 13   | 0    | 0    | 0    | 3    | 0    | 0    | 0    | 0    | 0    | 0    |
| Hybognathus regius               | E. Silver Minnow    | 0     | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Lucius chrysoleucus              | Striped Shiner      | 0     | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Notemigonus crysoleucas          | Golden Shiner       | 0     | 1     | 0     | 5     | 1    | 5    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Notropis amoenus                 | Comely Shiner       | 0     | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Notropis analostomus             | Saimin Shiner       | 0     | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Notropis chalybaeus              | Ironcolor Shiner    | 0     | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 3    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Notropis hudsonius               | Spottail Shiner     | 2     | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Notropis proseus                 | Swallowtail Shiner  | 0     | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Rhinichthys atratus              | Blacknose dace      | 0     | 0     | 1     | 0     | 2    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Notropis bifrenatus              | Bridal Shiner       | 0     | 0     | 0     | 0     | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Poeciliidae                      |                     |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Gambusia holbrooki               | Eastern Mosquitofish| 14    | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
Table 6-2. (Continued)

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Migratory Fish

The St. Mary’s River was rated a score of 1 in the 1998 Watershed Assessment due to its low diversity of spawning habitat for American Shad, Hickory Shad, Alewife, Blueback Herring, White Perch, Striped Bass, and Yellow Perch. Only one migratory fish was present, the Yellow Perch, indicating vulnerability to water quality impairment or physical blockages, or a combination of the two. Yellow Perch inhabit most Chesapeake Bay tributaries, and only migrate into freshwater streams during the early Spring. Fish sampling was conducted by Maryland Biological Stream Survey (1995) and the St. Mary’s River Project (1999, 2000, 2001, 2003, 2005, and 2008) and has been performed during the Summer in the non-tidal portion of the St. Mary’s River watershed. Yellow Perch were present in two sample sites in 2001, and absent in all other sampling sites and years. However, the American eel, a catadromous fish, was found in all 13 sites and consistently through each sampling year.

American eel captured off the dock at St. Mary’s College of Maryland.
Photo credit: Bob Lewis—St. Mary’s River Watershed Association

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Oysters

The 2013 Annual Fall Oyster Survey, conducted and published by the Maryland Department of Natural Resources (MDNR) Fisheries Service, is the most recent status report of Maryland oyster populations. These surveys have been performed annually since 1939 and assess the natural strike of spat (juvenile oyster recruitment), oyster mortality, and disease levels at over 40 sites in the Chesapeake Bay. Two sites, Chicken Cock and Pagan Point, are located in the St. Mary’s River.

As of the 2013 sampling period, oyster spat recruitment was above the 29 year median, with recruitment primarily in the lower Chesapeake Bay. Oyster disease levels throughout the Bay continue to be low, having remained below the long-term average for the 10th year, after record highs were observed in 2002. Dermo disease (caused by the parasite *Perkinsus marinus*) is still present in all surveyed oyster populations while MSX disease (caused by the parasite *Haplosporidium nelsoni*) has declined from being present at 90% of sites in 2002 to 9% in 2013. As a result of low disease prevalence, oyster survival rates in the Bay has increased, almost reaching those observed in 1985. Over the past 3 years, survival rates of oysters in the Bay have exceeded 90%. Annual changes in disease prevalence and total observed mortality for Chicken Cock and Pagan Point are shown in Figure 5-4 with the data available in the 2013 MD DNR Oyster Population Survey.

Dermo disease prevalence was relatively low in 2013 at Chicken Cock (50%) and was maintained at normal levels at Pagan (77%). MSX disease has been absent at Pagan and Chicken Cock since 2010 and 2011, respectively. Total observed oyster mortality was low in 2013 at both Chicken Cock (1%) and Pagan (4%).

Spat recruitment on the western shore of MD was highest at Pagan in the St. Mary’s River with

![Disease prevalence and total observed mortality for the St. Mary’s River oyster bars Chicken Cock (A) and Pagan (B) from 1990-2013.](image)

**Figure 6-4.** Disease prevalence and total observed mortality for the St. Mary’s River oyster bars Chicken Cock (A) and Pagan (B) from 1990-2013.

Stylocus ellipticus, the Oyster flatworm, is another local oyster parasite.

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196 spat per bushel oyster shell in 2013. Aside from a few sites on the Eastern shore, Pagan remains one of the sites with the highest recruitment. Chicken Cock, however, continues to have a light recruitment at 15 spat per bushel shell. Annual spat recruitment at Chicken Cock and Pagan is available on Figure 5-5, using data in the 2013 MD DNR Survey.

Oyster harvests, shown below, for the St. Mary’s River and Smith creek display a precipitous decline from 1985 through 2004. Despite the overall decline, increases in oyster harvests occurred in the 2011-12 and 2012-13 seasons, 10,000 bushels greater than in previous years (seen in Figure 5-6).

**Figure 6-5.** Annual spat recruitment, measured by spat per bushel of shell, for Chicken Cock and Pagan bars from 1985-2013.

**Figure 6-6.** Combined annual oyster harvest of St. Mary’s River and Smith Creek from 1985-2013.
Ecological Roles of Filter Feeders

Filter feeders, or suspension feeders, are organisms that strain suspended particles during the process of feeding, while simultaneously improving water quality. The most crucial filter feeder in the Chesapeake Bay and also the St. Mary’s River is the Eastern Oyster, *Crassostrea virginica*. As oysters move water across their gills, particles become trapped in the mucus layer and are transported along the gills by cilia towards the oysters mouth. Acting like a sifter, the gills transport particles of a certain size range into the digestive tract of the oyster. All other particles are still retained in the mucus, but are expelled from the oyster as small mucus packages, or pseudofeces. These pseudofeces sink to the bottom and are consumed by benthic detritivores. These detritivores range from invertebrates like snails, worms, and crabs, to bacteria and other benthic microbes.

The filtering process, in which the oysters selectively consume phytoplankton like algae, improves water clarity as algae are assimilated into oyster biomass. Oysters also remove bacteria, detritus, and fine particles of silt and clay from the water. These particles drop out of suspension when they become packaged as pseudofeces, allowing them to become available to other benthic organisms as a food source. The reduction in phytoplankton reduces the risk of hypoxia from eutrophication. Additionally the increase in water clarity enables the survival of submerged aquatic vegetation as sunlight can permeate down through the water column to benthic communities.

Oysters, which form a reef structure by attaching to one another, also can support a diverse community of benthic and pelagic species by providing refuge and food sources. Anemones, flatworms, mud crabs, blue crabs, and various small fish rely on juvenile oysters or oyster larvae as a food source. These reefs also improve coastline stability as they create a solid structure, reducing erosion during storm events. As oysters sequester calcium carbonate to form their shells, they also serve as a sink for carbon. However, the ecosystem services provided by these filter feeders has been significantly reduced due to overharvesting, disease, and decreased habitat availability.

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18 ibid (Oysters, Chesapeake Bay Program)
Species abundance and richness generally reflected stream conditions. The Craney Creek station, which was a new station sampled in 2008, had a considerably poor insect community with few insects and low diversity. Hickory Hills (NT 06) and Pembrook Run (NT 11), which were better than Craney Creek, also had low insect numbers in comparison to other stations. Although insect numbers in pollution sensitive orders varied, Pembrook Run lacked *Ephemeroptera* and *Trichoptera*, and Craney Creek lacked *Ephemeroptera* and *Plecoptera*. At other stations, with the exception of Warehouse Run (NT02), had at least 30% pollution sensitive orders. However, in some cases this proportion is misleading due to an overall low number of insects collected at those stations.

Additionally, a curious anomaly of high insect densities occurred at the landfill tributary (NT05) in 2008, which is historically known for water quality problems from bank erosion and siltation. The station sustained a relatively high insect diversity in 2000 and low densities in 2001 and 2005.

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**Benthic Macroinvertebrates**

Macroinvertebrate diversity and abundance indices are used to assess the water quality in freshwater streams and rivers. The absence of pollution sensitive orders, including mayflies (*Ephemeroptera*), stoneflies (*Plecoptera*), and caddisflies (*Trichoptera*) and dominance of pollution-tolerant orders, such as aquatic worms (*Oligochaetes*) and non-biting midges (*Chironomids*) are indicators of pollution. Methods for quantifying biological integrity of streams are based on species richness, the number of different species present, and species abundance, the number of individuals of each species. Although this can be used to assess environmental conditions, it may also reflect natural factors that influence species abundance, such as predation or competition.

In the St. Mary’s River Water Quality Assessment, benthic macro invertebrates were surveyed at the non-tidal stations (previously mentioned, Fig. 5-3) by the St. Mary’s River Project in the spring of 1999, 2000, 2001, 2003, and 2008. However, not all stations were sampled during each sampling year. Additionally, in 2008 three addition stations were sampled. Throughout the SMRP study 57 families of aquatic insects were collected at the non-tidal stations. The 2008 sampling period appeared to be a good representation of historic levels (from the 1998 Lower Potomac River Basin, Environmental Assessment) which comprised of 56 families of insects in the lower Potomac watershed. Of the insects collected in 2008, the most common orders included *Diptera* (31.6%), *Ephemeroptera* (29.7%), *Odonata* (14%), *Plecoptera* (9.6%), while *Trichoptera* and *Coleoptera* were less abundant, and *Megaloptera* and *Hemiptera* were relatively rare.

Table 6-3. Number of macroinvertebrates, by family, collected at each site. Adapted from St. Mary’s River Water Quality Assessment Final Report (2008).

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Total number of individuals: 93 85 23 73 56 24 94 8 65 522
Total number of families: 14 20 13 12 16 9 11 4 7
**Why Look at Benthos in Streams?**

Benthos are sometimes called “stream bugs” though that name overly simplifies the diverse membership of this group of bottom dwellers. Unimpaired natural streams may support a great diversity of species ranging from bacteria and algae to invertebrates like crayfish and insects to fish, amphibians and mammals. Benthic macroinvertebrates, collectively called benthos, are an important component of a stream’s ecosystem. This group includes mayflies, caddisflies, crayfish, etc., that inhabit the stream bottom, its sediments, organic debris and live on plant life (macrophytes) within the stream.

The food web in streams relies significantly on benthos. Benthos are often the most abundant source of food for fish and other small animals. Many benthic macroinvertebrates live on decomposing leaves and other organic materials in the stream. By this activity, these organisms are significant processors of organic materials in the stream. Benthos often provide the primary means that nutrients from organic debris are transformed to other biologically usable forms. These nutrients become available again and are transported downstream where other organisms use them.

Benthos are a valuable tool for stream evaluation. This group of species has been extensively used in water quality assessment, in evaluating biological conditions of streams and in gauging influences on streams by surrounding lands. Benthos serve as good indicators of water resource integrity because they are fairly sedentary in nature and their diversity offers numerous ways to interpret conditions. They have different sensitivities to changing conditions. They have a wide range of functions in the stream. They use different life cycle strategies for survival.

---

High Quality Habitat for Forest Interior Dwelling Species (FIDS)

FIDS include year-round residents and migratory bird species that require continuous forested areas sustain their populations. These species, having inhabited terrestrial ecosystems for thousands of years, remain a crucial component of the local landscape and history. However, as forested areas become developed and fragmented, populations of some FIDS have declined significantly. Forest fragmentation directly reduces available habitat for resident and migratory birds to feed and breed. This is particularly of consequence to migratory birds that are reliant on these areas as either temporary stopovers or final destinations in their annual route. Fragmentation also influences habitat quality, as high-value areas, that once contained more abundant, diverse, or nutrient-rich food sources than adjacent regions, could be reduced or eliminated. Habitat remaining in these fragmented areas subsequently experiences edge effects, further degradation at the forest edge, facilitating a reduction in plant diversity, leaf litter, and subsequently prey availability. Additionally, edges increase predation of eggs and juvenile birds.

Bird Breeding Abundances

Breeding bird populations in the St. Mary’s River watershed were assessed by the Maryland Ornithological Society’s Breeding Bird Atlas Project in 1983-1987 and 2002-2006. This study compared relative species abundance by the observed breeding activities identified in the two survey periods. Using a qualitative scale, individuals of each species were assigned to the following categories with point values:

1. Not Observed (0 pts)
2. Observed (1 pts) – present but not in breeding habitat
3. Possible (2 pts) – heard and seen in breeding habitat during breeding period but without other indicators of breeding
4. Probable (3 pts) – showing various signs of breeding activity, such as mating or territorial activity
5. Confirmed (4 pts) – presence or clear sign of an active nest, eggs, nestlings, or recently fledged young.

For each study period, median and mean values were calculated by species and study block (11 in total) within the St. Mary’s River watershed. Changes in species median and mean values between study periods corresponded to a change in relative species abundance. Only species that occupied habitats likely to be adversely affected by economic development in the watershed were compared in this study; habitats included mature forest, regenerating forest, brush-lands and forest edge, open fields and grasslands, freshwater

marsh, tidal marsh, beach and bare ground, shore line and open water. Common species associated with human dwellings and towns were not included in the results: European Starling, American Robin, Northern Mockingbird, and House Sparrow. Thirty-three species (35%) appeared to have increased between survey periods (Table 5-4.). Some species showed substantial increases, including the Mute Swan (invasive), Canada Goose, Pileated Woodpecker, Bald Eagle, White-breasted Nuthatch, Northern Parula Warbler, Worm-eating Warbler, and House Finch. Decreases in relative species abundance occurred in 9 species (10%, Table 5-5) with the largest changes occurring for Northern Bobwhite, lesser changes in American Black Duck and Least Tern. No changes were determined in 52 species (55%, Table 5-6).

It is encouraging that 91% of the bird species showed no decrease. An appreciable number increased. It thus appears that there was little or no significant loss of avian habitats during the two decades separating the surveys. However, The big drop in Northern Bobwhite, and the somewhat less drastic drop in American Woodcock deserve comment. Both species nest on the ground, and therefore are vulnerable to predators such as the house cat and domestic dog. As more houses are built in the watershed, even if there is slight effect on habitat, the cats and dogs associated with the households might account for the disappearance of these vulnerable birds.

The disappearance of the American Black Duck may reflect continuation of a long-term decline of the species in North America (D. W. Meritt, page 76 in Robbins and Blom 1996). The Least Tern requires undisturbed beaches with little or no vegetation, and frequently abandons an area when there is disturbance or overgrowth of vegetation (J. McKearnan, page 168 in Robbins and Blom 1996). Thus it is not surprising that this bird disappeared from the one block (Piney Point SE) where it was confirmed to breed in 1983-87.

Since this study no additional data on bird breeding abundance has been collected in the watershed. However, it is likely that there has been little to no substantial changes in abundance for most species. Additionally, current FIDs habitat in the watershed is shown in Map 13.

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Table 6-4. Bird species that appear to have increased in breeding status between 1983-87 and 2002-06, according to the Maryland Ornithological Society Breeding Bird Atlas surveys in the St. Mary’s River watershed. Asterisks notate species that have changes considerably between surveys.

<table>
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<th>Species</th>
<th>Median 1983-87</th>
<th>Median 2002-06</th>
<th>Mean 1983-87</th>
<th>Mean 2002-06</th>
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<td>1.9</td>
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Osprey in Upper St. Mary’s River

Mallard duck female near St. Mary’s College of Maryland
Table 6-5. Bird species that appear to have decreased in breeding status between 1983-87 and 2002-06, according to the Maryland Ornithological Society Breeding Bird Atlas surveys in the St. Mary’s River Watershed. Asterisks notate species that have changed considerably between surveys.

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<th>mean 1983-87</th>
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Great Cormorant out for a swim

Hooded Merganser

Clapper rail sighted in tidal marsh, upper St. Mary’s River, October 2013
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<tr>
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<td>4</td>
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<td>3.4</td>
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<td>Fish Crow</td>
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<td>3.2</td>
<td>3.2</td>
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<tr>
<td>Carolina Wren</td>
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<td>Red-eyed Vireo</td>
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<td>1.9</td>
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</tr>
<tr>
<td>Northern Cardinal</td>
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<td>4</td>
<td>3.6</td>
<td>3.7</td>
</tr>
<tr>
<td>Blue Grosbeak</td>
<td>3</td>
<td>3</td>
<td>2.5</td>
<td>3.1</td>
</tr>
<tr>
<td>Indigo Bunting</td>
<td>3</td>
<td>3</td>
<td>3.1</td>
<td>3.3</td>
</tr>
<tr>
<td>Field Sparrow</td>
<td>3</td>
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<td>2.5</td>
<td>2.3</td>
</tr>
<tr>
<td>Grasshopper Sparrow</td>
<td>2</td>
<td>3</td>
<td>2.2</td>
<td>1.7</td>
</tr>
<tr>
<td>Song Sparrow</td>
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<td>3</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>Red-winged Blackbird</td>
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<td>Eastern Meadowlark</td>
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<tr>
<td>Orchard Oriole</td>
<td>3</td>
<td>3</td>
<td>2.9</td>
<td>2.7</td>
</tr>
</tbody>
</table>

Table 6-6. Bird Species that do not appear to have changed in breeding status between 1983-87 and 2002-06, according to the Maryland Ornithological Society Breeding Bird Atlas surveys in the St. Mary’s River watershed.
Sensitive Areas

Sensitive areas are imperative to preserving the ecosystem services of the natural environment. These areas contain socially and economically valuable natural resources that directly influence public health, community security, and sustainability. In St. Mary’s County, sensitive areas are protected through zoning and easements.

Streams and Stream Buffers

The St. Mary’s River Watershed contains 174.9 miles of perennial and intermittent (seasonal) streams. These streams are slow-flowing, meandering systems whose structure provides along its banks for detritus from the terrestrial environment to settle and be processed by organisms. Through processing, these nutrient sources are made available for other organisms downstream in larger tributaries and rivers. Streams also contribute to and are supplied by groundwater, naturally filtering water for public and agricultural use. These systems also support a variety of aquatic and terrestrial organisms that are intrinsically valuable.

Stream buffers, which include wetlands, floodplains, and steep slopes, contribute to the health and ecological function of stream habitats. Vegetation that lines stream banks supply detritus, reduce erosion and serve as biological filters, by sequestering nutrients in storm water runoff. As a result of development, stream buffers have been reduced over time and impervious surface area has increased in adjacent areas. Sedimentation, nutrient inputs, and water velocity during storms have increased. Subsequently, biological productivity in these streams is reduced due to changes in water quality and clarity, flushing of detritus from the system, and stream bank erosion. Excess nutrient loads in the watershed have resulted in eutrophication, hypoxic events, and a subsequent decrease in aquatic animal health, abundance, and diversity.

To reduce human impacts on streams, perennial and intermittent streams are incorporated into a Sensitive Area Overlay Zone (SOAZ), defined as 50ft from each side of the bank, or at least 100ft if in the Critical Area. When the zone includes steep slopes or highly erodible soil, the 50ft distance is increased by 4ft for 1% increment above 15%. Additionally, when the SOAZ adjacent to or is 25ft from non-tidal wetlands or hydric soils, the SOAZ is expanded to include a 25ft buffer from those areas.

This zone is protected by limiting activities within the area to monitoring, restoration, and management. Forestry activities performed in accordance with the forest management plan are permitted 50ft from the stream bank. Trees can be cut for personal use in the SAOZ if replaced in a 3 to 1 ratio for each tree removed. Agriculture is allowed within 25ft of a forested or 50ft grassed buffer if permitted by the soil conservation and water quality plan.

Storm water management facilities may be permitted in the zone if no alternatives are feasible but are required to manage their own storm water and design the site to allow for groundwater recharge.

The addition or modification of structures in the SAOZ is only permitted by the Board of Appeals for public transportation, sewer, water, and gas if no alternatives exist and if disturbance to the area can be minimized. Modification of preexisting sites must result in a 10% improvement in storm water runoff from pre-development levels.

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Sensitive Areas Continued

New development is required to supplement at least 15% of forest cover in the SAOZ.

Wetlands

Wetlands occupy the transitional zone, between the land and water, which typically contains hydric soils, sediments that are periodically flooded. Wetlands serve as a natural filter and reservoir by slowing the flow of storm water, in terms of volume and velocity, and allowing for some water to be discharged from, and occasionally permeate into, ground water. The vegetation in wetlands reduces erosion and functions as a depositional zone for fine sediments in runoff, maintaining water quality and clarity. Wetlands also serve as a nutrient sinks, transforming and retaining nutrients in vegetation, and additionally withholding dissolved chemical pollutants.

Wetlands also support various species of birds, fish, and mammals, by providing critical habitats and microhabitats. However, these services can be impacted when wetlands are drained, filled, or the adjacent land is cleared. These wetlands are also at risk for species displacement by the introduction of non-native species.

Historic wetlands were likely present in areas that contain hydric soils, soils that are typically saturated with water. Regions with this soil type and no existing wetlands are ideal for restoration projects. Wetland restoration should also be promoted in headwater or source streams, which typically receive excess nutrients and sediment, and are optimal at reducing these inputs. Similarly, wetland stream buffers support diverse natural systems, capable of transporting usable nutrient sources to downstream communities.

According to the Chesapeake Bay Program, over 6,000 acres of wetlands were established, rehabilitated, or reestablished between 2010 and 2013 in the Chesapeake Bay watershed. However, the goal of 85,000 acres of wetlands (83,000 acres on agricultural lands) by 2025 appears to be far from achieved.

Wetlands in the St. Mary’s River watershed, according to DNR (Map 17), occupy 3,977 acres, of which 546 acres are estuarine and 3,424 acres are in freshwater areas. Non-tidal, freshwater wetlands were tracked by Maryland Department of the Environment between 1991 and 2004, and show a slight increase in the area of these wetlands during that time.

Flood Plains

Flood Plains are areas that either experience periodic flooding, particularly during storm events, or contain alluvial soils. Development in the 100 year flood plain is restricted by the county, while construction in this area should be avoided when possible. However, when development does occur in these areas impervious surface can significantly influence the movement of stormwater, resulting in erosion

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30 Prioritizing Sites for Wetland Restoration, Mitigation, and Preservation in Maryland, St. Mary’s County. 2006. Maryland Department of the Environment
31 Sensitive Areas Plan Element, cited on previous page
Sensitivity Areas Continued

and pollution from runoff. Mitigation strategies include maintaining a buffer between the floodplain and impervious surface.

Areas in the St. Mary’s River watershed that are affected by flooding include Carthagena Creek, St. George Creek, Hilton Run and Eastern Branch, St. Mary’s River, and Jarboesville Run.

Steep Lands

Although most of St. Mary’s County has a flat topography, some areas contain steep slopes. Human disturbances to steep slopes that are adjacent to water bodies can significantly impact aquatic life and shoreline vegetation. Steep slopes are capable of supporting diverse communities as environmental conditions can vary spatially along the slope, forming microhabitats. Therefore, these areas (even artificially created slopes) are managed to maintain biodiversity by avoiding unnecessary human disturbance.

Development is limited on slopes greater than 15% and prohibited on those 25% or greater. In the St. Mary’s County Development District, slopes greater than 15% and which contain highly erodible soils are discouraged for development, especially if there is potential for impacting water quality. However, these areas may be developed if erosion levels do not increase as a result of development. Any development on steep slopes 15% or greater is limited to clearing 30% of vegetation and adding 15% of impervious surface.

Slopes that border stream buffers and non-tidal wetlands are deemed priority protection areas, to be preserved. However, slope area, contiguity, and distance from wetlands and stream buffers can greatly affect their priority level for preservation.

Development of steep slopes is specifically discouraged in the areas between Three Notch Road and the Patuxent river. Incentives are provided to encourage development outside of these areas. Additionally, slopes present in developed areas are preserved in open space. Best management practices are also used to permit natural drainage while minimizing erosion on steep land.

On slopes exceeding 25% agriculture, forestry, mining activities, and roadways are permitted. However, roadways are limited to a maximum slope of 30%. This policy, which advocates for the preservation of steep slopes, also allows roadway development in the form of re-grading.

Areas in St. Mary’s River watershed with steep slopes are shown on Map 7.

Greenways

Greenways are defined as corridors that connect natural hubs (open space of at least 100 acres in size), provide contiguous areas for wildlife, maintain water quality, and enable public use for recreation and environmental education. Beginning with the Maryland Greenways Commission in 1990, the protection of potential, extensive natural corridors was advocated for at the federal, state, and private levels. In development areas, greenways can still be connected through open spaces.

In St. Mary’s River watershed, a greenway would connect St. Mary’s City to St. Mary’s River State Park.

At the heart of this region however, Lexington Park continues to be developed and

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32 Ibid (Sensitive Areas Plan, cited previously)
therefore limits the functionally of this potential greenway. Despite this, the protection of sensitive areas in light of further development should still be a priority in order to maintain terrestrial and aquatic resources.

**Natural Heritage Lands**

St. Mary’s County, which contains wetlands, tidal marshes, and freshwater streams, supports a highly diverse ecosystem. However, over the last 350 years, significant species declines have been experienced in Maryland as a consequence of habitat loss and degradation. In order to prevent new extinctions, habitats that contain rare, threatened, or endangered species are protected in Natural Heritage Areas. To qualify under this designation, the area must contain one listed species, have a distinctive habitat in terms of its geology, hydrology, climate, or biology, and be the foremost example of this type of area in the state. If it is not a significant habitat in respect to the state, these areas can be protected locally as a Critical Area if the species or habitat in question is uncommon or limited in distribution. Natural Heritage areas are otherwise regulated by the Department of Natural Resources.

**Lands with Rare, Threatened, & Endangered Species**

Six RTE species are found in the St. Mary’s River watershed. Three are rare plants: bent-awn plumgrass, pale mannagrass, and tobacco weed, a highly rare plant. Three are animal species: the eastern narrow-mouthed toad; a highly rare fish, the flier, and the bald eagle. The five locations for these species within the St. Mary’s River Watershed were described in the Conservation Summary for St. Mary’s County:31

- St. Mary’s River Bottomland (10)
- St. Mary’s Fish Management Area (11)
- West California Swamp (15)
- Jarboesville Run (23)
- St. Mary’s River Watershed (24)

The Eastern narrow-mouthed toad lives under the bark of fallen logs and breeds in vernal pools in the St. Mary’s River Bottomland, which has been designated a special protection area. This status is given to areas with high quality or unusually sensitive water resources and environmental features that would be threatened by land development without special water quality protection measures. Located primarily within St. Mary’s River State Park, the Mary’s River Bottomland is a heavily wooded floodplain. Because portions are very wet, they provide breeding sites even in dry years. As winter approaches, the toads move to high ground, where they overwinter in burrows.

The St. Mary’s River Fish Management Area also is a special protection area. Comprising of 520 acres, a lake, and surrounded by forest, the area provides habitat for flier fish.

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Table 5-7 lists the RTE animals and plants found in the St. Mary’s River Watershed and their associated locations (see Figure 5-7). Sensitive Species areas are shown in Map 20.

**St. Mary’s River Bottomlands Heritage Area**

The St. Mary’s River Bottomland, located to the west and south of the Lexington Park Development District (LPDD), is a 1,500 acre wooded floodplain. This area contains habitat for rare, threatened, and endangered species, and is therefore a Wetland of Special State Concern. As the majority of the Bottomlands is located within St. Mary’s River State Park it is relatively protected.

The Bottomlands are also a part of green infrastructure, forming contiguous ecologically significant lands between LPDD at Jarboesville Run and the areas north and south of St. Andrew’s Church Rd, Route 4.

<table>
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<tr>
<th>Map Number</th>
<th>Site</th>
<th>Area (acres)</th>
<th>RTE Species</th>
<th>Special Protection</th>
<th>Comments</th>
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<tr>
<td>10</td>
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<td>1488</td>
<td>Eastern narrow-mouthed toad</td>
<td>Managed by Washington Suburban Sanitary Commission (WSSC)</td>
<td>State parkland, steep slopes, buffers, wetlands, hydric soils, floodplains</td>
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<tr>
<td>11</td>
<td>St. Mary’s River Fish Management Area</td>
<td>520</td>
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<td>Lake with forest buffer</td>
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<tr>
<td>15</td>
<td>West California Swamp</td>
<td>23</td>
<td>1 state–endangered sedge *Status questionable</td>
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<td>Potentially impacted by past development. Located in development district.</td>
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<td>Ironcolor shiner</td>
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<td>Bent-awn Plume grass Pale mannagrass</td>
<td>WSSC State parkland</td>
<td></td>
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</tbody>
</table>

**Table 6-8.** Sensitive areas in the St. Mary’s River watershed containing threatened and endangered species. Information sourced from the Maryland Department of Natural Resources Wildlife and Heritage Service.
Figure 6-7. Natural heritage areas with rare, threatened, and endangered species (Courtesy of the Center of Watershed Protection).
Impervious Surfaces

Impervious surfaces are defined as artificial structures that reduce infiltration of water, subsequently increasing runoff. Impervious surfaces include roadways, rooftops, parking lots, and other paved surfaces. St. Mary’s River watershed contained 4.7% impervious surfaces in 1998. A study by the Center for Watershed Protection states that at 10-15% imperviousness, significant stream degradation occurs, suggesting that development should be limited to that percentage in the watershed. Additionally, to reduce the scale of disturbance, development should be reduced to clusters of high density. This, however, may result in poor stream health near high density areas, while relatively good quality is maintained in the rest of the watershed. Further mitigation in areas with high imperviousness can be achieved with storm water management facilities.

The locality of headwater streams to high density areas is also crucial in the development of storm water management techniques, as these streams maintain water quality for the water bodies downstream.

Figure 7-1. Proportion of Land Use in St. Mary’s River watershed in 2010. Adapted from the BSID Analysis of the Department of the Environment.

Population Density

The highest population density in the St. Mary’s River watershed is in the county’s 8th district, which contains Lexington Park, California, and Great Mills. In the Transportation Development Plan Final Report (KFH Group, 2013), population densities in 2010 within the Lexington Park Development District ranged from 501 to over 2,001 persons per square mile while other areas in the St. Mary’s River watershed were estimated to have a density of 101-500 persons per square mile.

According to the 2010 St Mary’s County Comprehensive Plan, low-density residential development (< 2 units per acre) has contributed considerably to urban sprawl in the watershed, resulting in the loss of forest and agricultural land. The Maryland Department of planning has estimated that for every 95 acres of agricultural and forest lands lost, approximately 100 households are created. By implementing Smart Growth strategies, which concentrate growth in
development districts, these 100 households can instead be contained in 8 acres.

**Historic Wetland Loss**

Wetlands in St. Mary’s County were mapped in two survey periods, 1981-82 and 1988-89, by the U.S. Fish and Wildlife Service to identify areas experiencing losses and gains in acreage. St. Mary’s County was identified to have 16,730 acres of wetlands (7% total area) in the 1988-1989 survey, with 10,072 acres of palustrine (freshwater marshes and forested wetlands) and 6,629 acres were estuarine (salt and brackish marshes).

The two sampling periods identified that 143 acres of wetlands have been lost, with 49 acres of (mainly forested) wetlands being converted to housing, agriculture, or commercial development. Pond construction contributed to an increase in 111 acres of palustrine, non-vegetated wetlands. This study, however, did not assess the quality of the remaining wetlands, as increased sedimentation, ground water usage, and pollution is what was expected and has occurred since this study.

**Unbuffered Streams**

Stream buffers, which are crucial habitat for aquatic and terrestrial species, serve as mediators of urban pollution, maintaining water quality by filtering out oils, nutrients, pesticides/herbicides, and other contaminants that would otherwise enter the stream. Without these buffers, stream water quality becomes degraded from terrestrial inputs of nutrient, chemicals, and sediment.

These buffers, which include trees and wetlands, are deemed as sensitive areas, protected by State and Federal laws. In St. Mary’s County, perennial and intermittent stream buffers account for 50,220 acres, conserved in the 100 foot Critical Area.

**Soil Erodibility**

Highly erodible soils encompass 49,221 acres in St. Mary’s County. However, only areas within 300 feet of water or wetlands are required to be protected, accounting for 35,262 acres in the county.

Soil erodibility is influenced by a combination of factors, including plant cover, soil types, and the topography of the area. Most of St. Mary’s River watershed is moderate to high erodibility (See Map 15).

Erosion is a considerable threat to water quality, especially on construction sites, as sediment reduces water clarity, impacting aquatic vegetation and therefore reducing oxygen levels for other organisms. Sedimentation also directly affects benthic species, particularly filter feeders, as sediment reduces their ability to obtain food.

The Maryland Standard and Specifications for Soil Erosion and Sediment Control (2011) detail the methods taken to protecting erodible soils and minimizing the potential of erosion during development.

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6 ibid (Comprehensive Plan, previously cited)

**RPD Task Force Report**

The St. Mary’s County Rural Preservation District Task Force was created in 2007 by the Board of Commissioners to make recommendations in the preservation of agriculturally or environmentally valuable land. A report was prepared in 2008 outlining current efforts at that time and recommended future measures for protecting the Rural Preservation District (RPD). This committee has been meeting monthly since 2007, with its most recent meeting in 2011 with no future meetings scheduled.

In 2008, the St. Mary’s County Rural Preservation Task Force released a report discussing various efforts to preserve important land areas. The Maryland Agricultural Land Preservation Foundation (MALPF) obtained over 8,500 acres in easements. The Rural Legacy program accounted for 2,702 acres in land easements or fee estate purchases to protect areas in threat of urban sprawl. An additional 159 acres adjacent to the Mattapany Legacy Area, now called the Fenwick Property, has also been purchased by St. Mary’s County. The Transferable Development Rights (TDR) program included 1,656 acres, allowing for owners of preservation area to sell land rights to their property in exchange for development elsewhere. Additionally, the Maryland Environmental Trust accounted for 2,142 acres of family-owned land while the Maryland Historical Trust has preserved 303 acres of historically or culturally significant land. Map 14 shows areas of preserved land within the St. Mary’s River watershed.

For further information about these organizations, see:

*TDR* — [http://www.co.saint-marys.md.us/docs/TDRBrochure.pdf](http://www.co.saint-marys.md.us/docs/TDRBrochure.pdf)
*MD Environmental trust* — [http://www.dnr.state.md.us/met/](http://www.dnr.state.md.us/met/)

**2007 Encroachment Study**

The Encroachment Study Committee was formed in 2006 by the Southern Maryland Navy Alliance (a non-profit that advocates for the Patuxent River Naval Air Station). The study was a collaborative effort by local businesses, community members, and elected officials to evaluate and make recommendations on the encroachment of the Department of Defense facilities to the St. Mary’s County Commissioners. The study found that the Naval Air Station (NAS) Patuxent River and Webster’s Field support over 19,000 jobs in the county, serving as an integral part of the local economy.

Efforts to mitigate encroachment began in the 1970’s as the NAS Patuxent River submitted the Patuxent River Air Installations Compatible Use Zone (AICUZ) plan to the County. The AICUZ plan provided policy recommendations for incorporation into land use regulations to the benefit of the base and public. The expansion of NAS Patuxent River created a demand for additional residential and business development. This required the County to designate areas for future encroachment, and in the process coordinate with NAS Patuxent River Navy leadership to evaluate future development.

St. Mary’s County Commissioners formally adopted an AICUZ overlay zone in 1979. In 2002, the St. Mary’s County Comprehensive Zoning Ordinance recognized a Clear Zone and APZ-1 in which residential development is prohibited, and APZ-2 that allows for up to 2 residential dwelling units per acre. Encroachment into the APZ-2 zone is of high priority and the County has inhibited development in areas adjacent to areas in the APZ-2. Due to Base Realignment and Closure (BRAC) and recent aircraft advancements, the County’s AICUZ and its encroachment policy required amendments.

The recommendations made in the 2007...
encroachment study satisfy the following objectives:

1. **Improve communications between the County and Navy**
   Utilizing the NAS Patuxent River Complex Encroachment Action plan as a Memorandum of Understanding (MOU), the County and Commanding Officer of NAS can address anticipated or certain encroachment issues. Biannual meetings between the Commanding Officer and County representatives will be held to assess progress and future goals for in addressing these issues.

2. **Prohibit new residential development in APZ-2**
   Amendments to the AICUZ ordinance do not influence pre-existing development. Accident Potential Zones (APZ) are regions that aircraft accidents are most likely to occur.

3. **Establish a buffer zone**
   The boundaries of a buffer zone will define areas where noise mitigation is required and the density of residents is at its maximum. These zones are determined by the County government and development community, with additional consultation from the Navy.

4. **Address Webster Field encroachment issues**
   The Webster Field buffer zone will be in accordance with that of the NAS Patuxent River buffer. Land for this zone will be purchased or acquired through easement and funded by available military construction funds, land preservation programs, and the DoD. The AICUZ for Webster Field will be extended to include an APZ-1 and APZ-2.

5. **Assess benefits of a Joint Land Use Study (JLUS)**
   A JLUS has been used in other areas as a means to improve compatible land development policy.
   The Encroachment Action Plan (EAP), developed by the Navy, planned to identify other factors of encroachment, and develop short and long-term goals for mitigation. In addition to addressing development and noise, this plan would also incorporate other encroachment concerns, including urban growth, airborne noise, ordnance and munitions, competition for air, land, and sea spaces, light pollution, frequency spectrum (communications), threatened and endangered species, and maritime issues, such as merchant vessels (LNG tankers), ecological concerns, and other factors.
   The United States Department of the Navy did a study in 2009, providing additional context and recommendations for the county. The study talks extensively of noise levels.

**Lands with Significant Natural Resource Value and Large Area**

*Green Infrastructure*

Greenways are recreational trails that can serve as public, alternative pathways, by land or water, for traveling throughout the county. These paths would also create an ecological network, connecting large land areas.

In the St. Mary’s River watershed, these potential greenways include paddle or land trails between St. Mary’s City to St. Mary’s River State Park (Fig. 6-2). This greenway could also be extended to Potomac River Greenways.

An additional greenway proposed on the Lexington Park Development District Master Plan 2013 Staff draft includes a Three Notch Road hiking and biking trail, connecting from Pegg Road north into Charles County, with some

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sections completed in 2013. Current Green Infrastructure is shown in Map 12.

*Large Forest Blocks*

Large forest blocks are contiguous areas of wooded land, crucial as habitat for forest interior dwelling species that are vulnerable to forest fragmentation and degradation of edge habitat. These areas are defined as having at least 250 acres of contiguous land with a surrounding 300 foot buffer to reduce edge effects.12 St. Mary’s River watershed large forest blocks are shown in Map 13.

*Mining*

Mining in the watershed is limited to open pit extraction of gravel and sand, and the extraction of ground water (See section on aquifers for more information). Mining activities are limited to minimize impacts to water and habitat quality13. Habitat protection areas that contain mining prospects are to be protected.

Industry studies suggest the existence of natural gas resources in St. Mary’s County. At this time there is no indication that industry will pursue this resource in the near future.

As of 2013 there were nine mineral mines in the St. Mary’s River watershed (See Map 8).

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13Ibid (Comprehensive plan, previously cited)
Critical Areas, Resource Conservation Area, Limited Development Areas

Lands within 1000 feet of the tidal waters are governed by the Chesapeake Bay Protection Act of 1984—also known as the Critical Areas. Most of the tidal shoreline of the St. Mary’s River is zoned as Resource Conservation Areas (RCAs), areas where development is discouraged.

Within the RCA areas, floating overlays allow for additional development and intensity in two categories — Limited Development Areas (LDAs) and Intensely Developed Areas (IDAs).

LDAs in the St. Mary’s River watershed include marinas and the St. Mary’s College of Maryland’s waterfront. There are no IDA lands in the watershed. Generally, development is discouraged in the critical areas and specific restrictions and limitations are in effect for the 200-foot buffer to the tidal waters.

Fig 7-3. Critical areas (outlined in red) and protected lands in St. Mary’s County, Maryland.

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State-owned Parklands

The St. Mary’s River State Park is located in the northern end of the St. Mary’s River watershed. It is comprised of a wide range of habitats, from wooded acres and fields to swamps and small streams. The park hosts a diverse community of flora and fauna, including several threatened and endangered species such as the Narrowmouth Toad.

St. Mary’s River State Park is separated into a southern site and corresponding northern site. The southern area holds the 250-acre St. Mary's Lake and hosts a boat launching ramp. It is located along Maryland Route 5, between Leonardtown and Great Mills, at the end of Camp Cosoma Road. Several species of fish are common to the lake including largemouth bass, chain pickerel, crappie, bluegill, and sunfish. The lake has been designated a trophy bass lake and as such, special fishing regulations may be in effect. Fishermen should check bulletin boards or contact park personnel for details.

A 7.5 mile trail circles the lake, allowing the area to be fished from shore or by boat. The trail is regularly used for hiking, biking, and horseback riding. Permitted hunters can access designated sites for waterfowl hunting. Modern comfort stations, picnic tables, playground, boat launch ramps and a large gravel parking lot are provided. Picnicking is permitted but tables are limited. This is a fee area ($3 per vehicle or seasonal pass).

The area northeast of Indian Bridge Road comprises the second site. It is approximately 2,200 acres and is primarily undeveloped. It is a wildlands area and a managed hunting area. There are no formal trails in the wildlands, although trails abound from illegal motorized all-terrain vehicles. This area was preserved for the purpose of control downstream flooding. This is also a fee area, but note that not all access points support fee collection.

16Maryland Department of Natural Resources, St. Mary’s River State Park, Maryland Park Service, http://www.dnr.state.md.us/.publiclands/southern/stmarysriver.html
State owned Parkland continued

Salem State Forest adjoins the northern area of St. Mary’s State Lake and is bordered by St. Andrews Church Road. Salem State Forest and St. Mary’s River State Park contribute to a large contiguous area of preserved land in the St. Mary’s River watershed, ideal as a green corridor for wildlife and public recreation.

The Department of Natural Resources was purchased the Salem property (902 acres) in 2003 from a Pulpwood Company that had largely been harvesting loblolly pines and facilitating the growth of loblolly pine monoculture (plantations). At that time, 345 acres of the property had recently been clear-cut (2000), 108 acres had been treated with herbicides to promote succession and colonization of loblolly pine, and 275 acres contained established stands of loblolly. The remaining acreage sustains multi-species stands of pine, oak, and other hardwoods. The Department of Natural Resources’ efforts have concentrated on diversifying this area through various methods.

The Salem State Forest is available for the public uses of hunting, hiking, horseback riding, and biking. The State Forest is also connected to St. Mary’s Lake via the Salem Forest Trail. Similar to St. Mary’s River State Park, motorized vehicles are not permitted.

In January 2015, 854 acres of land adjacent to Salem State Forest was acquired by Maryland DNR and the Conservation Fund from the Walton Lumber company. This area was allotted for open space, which expanded Salem State Forest west across route 5 to span the St. Mary’s River and the Breton Bay watersheds. Development of additional trails, permitting easy access to this area, are expected in the near future.

Figure 7-5. Salem State Forest with land acquired in 2015.

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In the late 16th and early 17th centuries, England began efforts to develop a New World empire in North America. The beginnings were financed by allowing entrepreneurs, some of them joint stock companies, some of them individual proprietors, to establish colonies along the Atlantic seacoast. In 1632, Cecil Calvert, the second Baron of Baltimore, was granted a charter to what is now the state of Maryland.

Cecil’s father, George Calvert, had been King James I’s principal Secretary of State, at a time when tensions between Catholic Europe and Protestant England were high. Calvert championed a marriage between the King’s son Charles and a Spanish princess but the effort failed. Soon afterward, George Calvert resigned as Secretary and converted—or returned—to Catholicism (he had been Catholic until the age of 12 when he was forced to become Anglican). That the Protestant king granted the colony of Maryland to the Catholic George Calvert was remarkable—and Maryland was Calvert’s second land grant. His first was Avalon in Newfoundland, but after one exceptionally harsh winter, Calvert opted to return to England and lobby for land in a more temperate clime.

In the Maryland charter, largely written by Calvert, the king granted the Calverts princely rights, with the power to raise an army, collect taxes, make laws, and give away land. Clearly, the King held George Calvert in high regard, despite his religious convictions.

George Calvert had a long-standing interest in colonization. He invested in the Virginia Company and other early efforts. He applied lessons learned in these ventures to plan the Maryland colony. The preponderance of the investors in Maryland were Catholic and the majority of workers the investors transported to build the colony were Protestant, creating potential religious conflict that could destroy Maryland. To avoid this, the Calvert’s instituted a progressive policy of liberty of conscience, allowing people of varied faiths to freely worship in Maryland. Related to this was another revolutionary decision that the colony would have no official established religion, neither Catholic nor Protestant.

George Calvert did not live to see the founding of the colony. His son, Cecilius, inherited the charter. His second son, Leonard, led the adventurers who set off for the Chesapeake on the Ark and the Dove in November 1633, while Cecilius stayed in England to defend the charter. In 1634, the colonists established the first settlement and new capital of the colony, which they called St. Mary’s City. The Calvert’s hold on the fledgling colony was tenuous at best as Virginians, religious suspicions, the English Civil Wars, and political intrigues threatened or temporarily disrupted their efforts.

The second half of the century was St. Mary’s heyday, marked by a strong tobacco economy and growth in population that warranted construction of public buildings. For a time, the colony offered remarkable opportunities for economic and social advancement to those endowed with the ability to work hard and a bit of luck. But political and religious animosity again arose late in the century and a group of disgruntled Protestants led a revolution against Lord Baltimore in 1689. The crown appointed royal governors and they moved the capital from St. Mary’s City to Annapolis in 1695. The colonial statehouse was turned into a Protestant (Anglican) church in the same year; and in 1704 the principle
of liberty of conscience was dramatically overturned when Catholic churches and schools were closed in accordance with “An Act to Prevent the Growth of Popery within this Province.” Abandoned for the most part, St. Mary’s City sank back into the soil from which it had arisen and by the time of the American Revolution, little of Lord Baltimore’s capital was left but memories of its former importance.

Today, everything that once stood on the 17th-century town lands has disappeared—at least above ground. Fortunately, there was very little later development to destroy the site of what was once the first capital. Early in the 20th century, interest in the historical city revived and historical research and archaeological excavations began to uncover the 17th-century settlement. Because the old city had remained relatively undisturbed over the years, the area is one of the finest 17th-century colonial archaeology sites in the nation. St. Mary’s City has been recognized as a National Historic Landmark since 1969.

Decades of research are the foundation of exhibits at Historic St. Mary's City, the state museum that commemorates the state's founding. The museum’s archaeological collection of over 5 million artifacts is an internationally significant resource for professional archaeologists and other scholars. Dr. Lois Green Carr, staff historian since the inception of the research program in 1967, is broadly considered the dean of early Chesapeake studies. Dr. Carr's work has distilled the human spirit from the archival records and has greatly augmented the discoveries of archaeologists led by Director of Research Garry Wheeler Stone (1971-1986) and Dr. Henry Miller (1987 – present). From the beginning, the research program at HSMC has been a collaborative effort of historians, architectural historians and archaeologists working to explore the nature of early Maryland. It has served as a model for interdisciplinary research in Early American history. Dr. Carr’s books include Maryland's Revolution of Government:1689-1692 (with David Jordan:1971), and Robert Cole's World (with Lorena Walsh and Russell Menard:1991). The results of many of the historical research projects are available here, and the Maryland State Archives, web sites. For archaeological and architectural discoveries, see the Archaeology section of this site.
State owned Parkland continued

**Historic St. Mary’s City**

Located on the east bank of the tidal St. Mary’s River, Historic St. Mary’s City museum and park comprises approximately 800 acres along St. Mary’s River. It is a registered National Historic Landmark. The former British settlement has been recreated in the form of an early tobacco plantation on about 165 acres, the State House of 1676, a woodland Indian hamlet, several replica buildings and frames of buildings, and a recreation of the 17th century trans-Atlantic vessel, the Dove. The park is staffed by costumed interpreters who are there to help visitors learn about St. Mary’s City's past. Informative videos and displays enrich the experience. The park is also home to many significant archaeological finds which are interpreted through museum exhibits. Historic St. Mary’s City is open from mid March to late November. Hours of operation vary by season. Visit the official St. Mary’s City web site for operating hours: [http://www.stmaryscity.org/](http://www.stmaryscity.org/)

A 3.2 mile hiking trail wanders around the wooded southern portion of the property. Bikes and horses are discouraged and motorized vehicles are prohibited. Features include panoramic vistas of the tidal St. Mary’s River, tidal pond habitat, mature mixed forest habitat, and the historic 1840 Brome Howard Inn and slave quarters. There are another 2 miles of paved trails that wind through the exhibits; this is a ticketed area and no bikes or horses are permitted here.

The Historic St. Mary’s City museum and park are co-located with St. Mary’s College of Maryland, along Maryland Route 5, in St. Mary’s County.

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**Figure 7-6.** Boundaries of the City of St. Mary’s as Incorporated by Lord Baltimore in 1668. These form the basis for the National Historic Landmark of St. Mary’s City.
The county operates three parks within the St. Mary’s River watershed that have access to the water:
- Great Mills Canoe and Kayak Launch
- Piney Point Landing
- St. George Island Landing

Other county-run parks are:
- Chancellor’s Run Regional Park
- Great Mills Swimming Pool
- George B. Cecil Park
- Jarboesville Park
- John G. Lancaster Park
- Nicolet park
- St. Andrew’s Estates Park
- Carver Community Park

Hours of operation of county parks is typically sunrise to sunset. Check the county web site for specific hours: [http://www.co.saint-marys.md.us/recreate/](http://www.co.saint-marys.md.us/recreate/)

**Great Mills Canoe and Kayak Launch** is located on Maryland Route 5 about 75 yards south of the intersection with Indian Bridge Road. Parking is available for about 30 vehicles and access is from a small dock or steep bank. Generally, water levels in this stretch of the river are insufficient for paddling. A moderate rain in the winter and spring or heavy rains in the summer generate enough flow for paddling. Caution should be exercised when the river is high. There are no bathroom facilities at this 1.7-acre site.

**Piney Point Landing** is located on Piney Point Road (Maryland Route 249) at the bridge to St. George Island. The 2.83-acre site has parking for more than 50 cars and trailers and no bathroom facilities. Two well-equipped boat ramps provide good access for larger boats and boats on trailers. Two short piers provide access to the boat ramps and limited fishing. Fishing from the shore is encouraged. The shoreline is hardened with large boulders and presents difficult access for canoes and kayaks. A private access on the northeast side of the bridge has a sand beach and is ideal for paddlers.

**St. George Island Landing** is located at the end of Thomas Road on St. George Island. The 1/2 acre site has a fishing pier and no bathroom facilities.
Chancellor’s Run Regional Park is located on Chancellor’s Run Road, approximately 2 miles east of the intersection with Maryland Route 235. Dedicated in 1990, the 80-acre site hosts a variety of ball fields, an activity center, two sand volley ball courts, and the Softball Hall of Fame pavilion. Containing the most amenities of all the parklands in the watershed, Chancellor’s Run Regional Park facilities are available for rental and feature full commercial kitchen facilities and well as modern bathrooms. Lighting over ball fields provides for evening activities. Hiking/walking is encouraged on the site and there is one partially wooded trail. Access to the park, like all St. Mary’s County parks, is free. Service and facility charges may be required. There is no access to the river.

Great Mills Swimming Pool is located on Great Mills Road (Maryland Route 246) approximately 3/4 mile north of the intersection with Maryland Route 5. The 19-acre site is partially wooded and provides for some walking. The 25 yard x 25 meter pool includes six lanes and has a “zero depth” entry for maximum accessibility. The pool is covered with an air-inflated “bubble” from September until May to allow year round usage. The facility’s bathhouse includes showers, lockers, restrooms and a lifeguard room; a toddler pool is also part of the aquatic facility and will be open during the summer months. Access to the grounds is free. Fees are charged for use of the swimming pool.

Dedicated in 1983, the George B. Cecil Park is located on St. Georges Church Road approximately 1/3 mile west of the intersection with Flat Iron Road. The park provides baseball/softball fields, tennis courts, fixed playground equipment, picnic tables, and a pavilion. A concession building is on site with modern bathroom facilities.

The five-acre Jarboesville Park is located at the intersection of Thomas Drive and Williams Drive, and behind Lexington Park Elementary School. The park was dedicated in 1975 and provides fixed playground equipment, tennis courts, and baseball/softball fields. There are porta-a-potties on site.

John G. Lancaster Park is located on Willows Road approximately 1/4 mile south of the intersection with South Shangri La Drive. The approximately 47-acre park, dedicated in 2001 and expanded to 80 acres in 2010, features a fixed playground area as well as numerous ball fields, a dog-walk, picnic tables, pavilion, basketball and tennis courts, and hiking along the exterior as well as in the former Lexington Manor subdivision. Lighting on some ball fields provide for evening activities. Modern bathroom facilities are available.

Nicolet Park is located on the north side of the Patuxent Homes subdivision and is accessed from Bunker Hill Drive and Wasp Road. Fixed playground equipment compliment open areas, basketball courts, a softball/baseball field and two pavilions. The only county park with a skateboard facility, Nicolet Park hosts regional skateboarding competition annually. Lighting on some ball fields provide for evening activities. Modern bathroom facilities are available. The 35-acre park is open evenings for special events.

St. Andrew’s Estates Park is located at the end of St. Andrew’s Lane. The four-acre park hosts a 60-foot baseball field, a basketball court, picnic tables, and fixed playground equipment. Port-a-potties are provided seasonally.
The county purchased the 76-acre **Beavan property** in December 2008. The wooded site is located on Indian Bridge Road adjacent to the state-owned Salem Track and about 2000 feet south of the intersection with St. Andrew’s Church Road. The property has been suggested for use in the future for a combination of active recreation (ball fields, playground, restroom) and nature interpretation/natural resource protection. However, master planning would need to be done before any program is set for this property.

**Figure 7-7.** Beavan property boundary
Protected agricultural lands are scattered throughout the watershed and are protected under a variety of programs, which are outlined in section 9 of this report.

Four significant forested parcels provide for the beginnings of greenway corridors or pathways for wildlife to move about. A 203-acre parcel in the lower Hilton Run subwatershed, known as Hunting Quarter, is preserved in the Maryland Historic Trust program and provides protection from development for a vital section of marshes. These marshes and accompanying beaver dams help to further mitigate the polluting effects of intense development upstream.

Three other adjacent wooded parcels make up the Salem Tract Forest. Combined with an additional agricultural property currently enrolled in the Agricultural Preservation district program, these three parcels along with the adjacent and downriver St. Mary’s Lake State Park, provide excellent beginnings of a greenways corridor.

Monarch butterfly migrating through the St. Mary’s River watershed. Photo credit: Merideth Taylor, October 2011.

Common fungus Sparassis crispa spotted in the Park Hall area. Photo credit: Merideth Taylor.
Interpreting Local Conditions with Natural Soil Groups

Soil horizons, or the sequence of different types of soils, can provide information about the climate, vegetation, topography. Additionally, the presence of certain types of soil can be associated with the local conditions that led to their formation. St. Mary’s County, which is located on the low-elevation Coastal Plain, predominately has gravel, sand, silt, and clay sediments. Of the seventy-seven different soil types in the watershed, all are derived from marine deposits and most contribute to an acidic soil of low fertility. The distribution of these sediments is reflected in the present vegetation, that are generally suited for rapid permeability, erosion, and leaching of nutrients.

Soil group nomenclature is used to categorize soils by their features, with master soil horizons defined by capital letters, suffix symbols that describe additional important characteristics as lower case letters, and vertical subdivisions of master horizons as defined numerically.

Soils and Watershed Planning


<table>
<thead>
<tr>
<th>Horizon Symbol</th>
<th>General Description</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>Surface mineral soil horizon, generally darkened by accumulating humus.</td>
</tr>
<tr>
<td>B</td>
<td>Subsoil mineral horizon, generally characterized by accumulation, removal, or redistribution of iron, aluminum, silica, clay, humus, calcium carbonate, calcium sulfate, or sesquioxides.</td>
</tr>
<tr>
<td>C</td>
<td>Relatively unaltered mineral soil layer</td>
</tr>
<tr>
<td>E</td>
<td>Subsurface mineral soil horizon characterized by a loss of iron, aluminum, clay, or organic matter.</td>
</tr>
<tr>
<td>L</td>
<td>Organically derived limnic material deposited in water by chemical precipitation, aquatic organisms, or from plants.</td>
</tr>
<tr>
<td>M</td>
<td>Root-limiting, human-manufactured layer, including layers of asphalt, landfill liner or geotextile fabric.</td>
</tr>
<tr>
<td>O</td>
<td>Soil horizon composed dominantly of organic soil materials (but not limnic materials).</td>
</tr>
<tr>
<td>R</td>
<td>Consolidated hard, continuous bedrock.</td>
</tr>
<tr>
<td>W</td>
<td>Layer of water within or under soil (not at surface), such as floating bogs.</td>
</tr>
</tbody>
</table>

Soil, which includes the minerals, organic matter, liquid, and gas occupying a given space of land, is a valuable natural resource and directly influences land use. Soil surveys are performed by the United States Department of Agriculture Soil Conservation Service with the most current published manuscript available from 1978, and current data from 2014 available on the Web Soil Survey (http://www.nrcs.usda.gov/wps/portal/nrcs/soilsurvey/soils/survey/state/).

These characteristics can then be used to classify the capacity of the land for certain uses, such as cropland, urban, recreational, wildlife, or woodland. Soil groups are used to categorize soils by their properties in terms of soil productivity, erosion potential, permeability, stoniness, depth to water table, slope, and susceptibility to flooding. Soil groups in the watershed are shown in Map 15.

22 Natural Resources Conservation Service. Soil Survey of St Mary’s County, Maryland. 1978. United States Department of Agriculture, Natural Resources Conservation Service (formerly Soil Conservation Service), in cooperation with Maryland Agricultural Experiment Station.
WETLANDS

Wetland Categories

Tidal, Estuarine Wetlands

These wetlands, which are located in tidal areas of streams, creeks, and rivers, experience brackish water when flooded by the tide.\(^{24}\)

Non-tidal, Freshwater Wetlands

The majority of wetlands in the Chesapeake Bay watershed are located in non-tidal areas, including the floodplains of streams, lake or pond shorelines, isolated depressions or flat areas that can accumulate water.

Wetlands categorized by their vegetation:
- **Emergent Wetlands** containing grasses, sedges, or non-woody plants
- **Shrub Wetlands** with low to medium-height, woody plants
- **Forest Wetlands** with trees being the dominant species

Tracking Wetlands

The Chesapeake Bay Program (CBP) compiled data on established, rehabilitated, and reestablished wetlands to monitor total acreage on agricultural lands in the Chesapeake Bay watershed.\(^{25}\) Since 2010, ChesapeakeStat (available at http://stat.chesapeakebay.net/) allows for spatial data, collected annually by CBP partners, to be incorporated into mapping tools. State data collected through the CBP is submitted through the National Environmental Information Exchange Network (NEIEN) and used to estimate the Bay’s progress in reaching the Bay’s Total Maximum Daily Load (TMDL). Wetland restoration targets are outlined in the Watershed Implementation Plans (WIPs). Although increasing wetland acreage in agricultural areas is the goal, it does not indicate increases in wetland function.

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Climate Change

Solar radiation from the sun can either be absorbed or reflected back into space upon reaching Earth. Most solar radiation (received as visible light) is absorbed by the earth’s surface and atmosphere. Some of this energy is reflected back into space, but most of it is retained as heat energy by Earth’s atmosphere. Clouds (water vapor) and gases (carbon dioxide, methane and nitrous oxide) in the atmosphere absorb radiation reflected from the Earth’s surface, effectively maintaining the Earth’s temperature; this is known as the “greenhouse effect.”

Ice cores enable scientists to study long-term trends in concentrations of atmospheric greenhouse gas throughout Earth’s history. Although natural fluctuations in these gases have occurred in geologic history, Levels of these gases since the Industrial Revolution have increased at a much faster rate than in any other time in history. Most of this increase is from our use of fossil fuels—first coal and, later, oil and gas. The major consequence of increasing atmospheric carbon dioxide concentrations is a magnification of the greenhouse effect, which is responsible for today’s unprecedented warming of the planet.

The warming climate of Earth has led to subsequent disruption of global weather patterns. Heated air causes a positive feedback of warming as more water vapor is held in the atmosphere. This facilitates further evaporation and precipitation. On a global scale, this shifts precipitation patterns, causing extreme weather events including cyclones, droughts, floods, and forest fires.

Carbon dioxide concentrations in the atmosphere have increased significantly from the pre-industrial period (approximately 280 ppm from 1000-1750 to over 390 in 2014, with CO₂ continuing to accumulate in the atmosphere (40%), the land (30%), and the ocean (30%). The absorption of excess atmospheric carbon dioxide into the oceans has resulted in ocean acidification (decreasing pH of the seas). Since the Industrial Revolution, ocean pH has decreased by 0.1 standard units. Small changes in pH significantly impact calcifying organisms, such as oysters and blue crabs, by reducing the availability of carbonate which forms their shells.

Global average temperatures have already increased by 0.85 degrees Celsius from 1880 to 2012, while climatic models project a 1.5 to 2 degree increase (from 1850-1900 temperatures) by the late 21st century. Global evidence of climate change is most apparent in the melting of the Greenland and Antarctic ice sheets (3.5-4.1 % per decade), continual glacial retreat, and decreases in arctic sea ice and spring snow cover. Solar radiation is more readily absorbed by dark-colored land and sea than by reflective ice, so warming increases when ice sheets retreat and expose land and sea expanse. Additionally, as these water sources melt, inputs to the ocean contribute to global sea level rise. Historical data reveals that sea levels have already risen 0.19 meters between 1901 and 2010. Projections state that it is likely that the arctic will be “ice-free” by the middle of this century.

Reducing the impacts of climate change requires not only strategies for mitigation, but also adaptation as sea levels rise, severe storm events continue, and ecosystems decline. Mitigation strategies which are most effective will be those that include renewable energy implementation and energy conservation practices. Adaptation to a warming world includes strategies to protect and preserve human systems as well as our natural resources, which provide countless irreplaceable

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Sea level rise experienced in the Chesapeake Bay is due to a combination of natural land subsidence and global climate change. Land subsidence experienced in the Bay is mainly due to the compacting of the surface from groundwater withdrawals, and to a lesser extent due to the rebounding of the Earth's crust in response to glacial melt from the last ice age. Since the mid 1900’s, land subsidence has contributed a 1.1-4.8 mm/year decrease and accounts for at least half of sea level rise experienced in the Bay area.\(^{29}\)

The Fifth Assessment Report (2014) by the International Panel on Climate Change states that the likely scenario for projected global sea level rise is 8-16 mm/year (2081-2100, relative to 1986-2005).\(^{30}\) By 2100, it is likely that mean sea level rise will range from 0.85-1.8 ft (0.26-0.55 m). The maximum projected sea level rise, although less probable, is 3.2 ft (0.98 m). Including the effect of land subsidence on the Chesapeake Bay region, sea level rise is expected to rise 2.8-6.5 ft.

Coastal areas, that contain large areas at low elevation, are the most vulnerable to flooding and its subsequent effects from sea level rise.\(^{29}\) Impacts from sea level rise include damage to infrastructure and potential effects on coastal ecosystems from increased erosion and salt water intrusion. Marshes, which rely on tidal action, and wetlands (freshwater or saltwater) are particularly vulnerable as changes in sea level can alter nutrient cycling, sedimentation and salinity levels.

Hurricane and Storm Inundation

Storm events, exacerbated by sea level rise, have become more frequent and their impacts more severe from increased storm surge and coastal flooding. Storm surges are caused by the winds of low pressure areas in the storm system and push water from the Bay into its narrower tributaries. The subsequent flooding causes salt-water intrusion, affecting surface water, aquifers, and coastal vegetation. Surges can also exacerbate shoreline erosion, damaging local infrastructure and crucial natural resources. Map 18 shows coastal areas in the watershed that are likely to experience flooding during storm surges.

Impacts on shoreline communities and potential mitigation strategies are identified in the Phase I of Maryland Comprehensive Strategy for Reducing Maryland’s Vulnerability to Climate Change.\(^{31}\) These include a shift in infrastructure, allowing for the expansion of wetland migration corridors as sea levels continue to rise and an increase in wetland and forest buffers. Phase II provides strategies to tolerate and adapt to the effect of climate change on natural and human resources.\(^{32}\)

**Figure 7-8.** Sea level rise planning for St. Mary’s River. Adapted from VIMs County Map (http://ccrm.vims.edu/climate_change/slr_maps/index.html).
The Lexington Park Development District is the larger of the County’s two development districts. Land use is dictated by the *Lexington Park Development District Master Plan*, separate to and supporting the county’s *Comprehensive Plan*. The term “development district” refers to areas of St. Mary’s County designated in the Comprehensive Plan where the County directs and encourages development as part of its growth management strategy.33

The Lexington Park Development District extends from just south of Hollywood in the north to Hermanville Road in the south, and lies in the St. Mary’s River, Patuxent River, and Chesapeake Bay watersheds. It includes the communities of Lexington Park, California, and Great Mills. While the county’s *Comprehensive Plan* contains countywide land use policies, this plan details how these policies should be implemented in the Lexington Park Development District.34

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34 ibid.
Specifically, the *Lexington Park Development Master Plan* is intended to address the following questions:

- How can the Lexington Park - California - Great Mills Area become a better place to live, work, and play?
- Which areas are most suitable for growth? Which areas may be unsuitable?
- How should the LPDD relate physically and economically to other parts of the county?
- How should the different parts of the LPDD relate physically to each other?
- What public facilities such as schools, roads, and parks as well as transportation and public safety services are needed to serve the area?
- How should environmentally sensitive areas be best protected?

![Snapshot of Lexington Park Development District](image)

**Snapshot of Lexington Park Development District**

- 26 square miles
- 17,000 acres or about 7% of the county’s land area
- approximately 50% land area is developed
- 5% committed to development
- 5% parks and protected land
- 40% remains available for development
- 70% or about 11,900 acres are within the St. Mary’s River watershed
- Population 35,582 (2010 Census); projected to increase to 46,800 in year 2022

**SOURCE:** *Lexington Park Development District Master Plan; St. Mary’s County. Public Hearing Draft, September 2015, Section 1.2.1 (pg 1-2)*

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35 *Lexington Park Development District Master Plan; St. Mary’s County. Adopted 2005, pES-1.*
The first Lexington Park Development Plan was adopted in 2000 as part of the update to the St. Mary’s County Comprehensive Plan. This plan was incorporated into the Lexington Park Development District Master Plan, adopted November 1, 2005. Following the county’s Comprehensive Plan update in 2010, county officials began work on an update to the Lexington Park Development District Master Plan and the county adopted it on February 9, 2016.

The Lexington Park Plan is the master plan for the revitalization of the core area of Lexington Park—also known in earlier documents as the “wedge.” The revitalization of this area is an ongoing and necessary endeavor to tackle the consequences of aging and eroding infrastructure, deteriorating housing and neighborhoods, commercial blight, and the subsequent increasing incidents of crime. Two projects have been funded to address aging infrastructure.

The first project entailed the reconstruction of roads, sidewalks, curbs and gutters, and storm water inlets—and the replacement of all sewer and water lines throughout Patuxent Park, located north of Great Mills Road between FDR Boulevard and Pacific Drive/Pegg Road. The first of five phases began in 2009. In the spring of 2014, Phase 2 has been completed. Phase 5 is projected to be underway in 2018.

The reconstruction and enhancement of Great Mills Road at a cost of $5.5 million was completed in 2012 and provided upgrades to sidewalks, left-turn lanes, and center medians.

Sewer and water line reconstruction throughout Patuxent Park will be completed in four phases and will require approximately three years to complete. Roadway reconstruction requires five phases and will take approximately six years to complete. Funding for the replacement of sewer and water line in Patuxent Park is fully funded in METCOM’s projected budget. Likewise, roadway reconstruction funding is earmarked in the County’s six year Capital Improvement Project’s budget although funding must be authorized annually. Sewer and water line reconstruction is projected to cost an additional $1.6 million. Roadway reconstruction in Patuxent Park is projected to cost $6.8 million.
Figure 7-11. Land uses in Lexington Park Development District. Map courtesy of Lexington Park Development District Master Plan Staff Draft (http://www.co.saint-marys.md.us/lugm/LPDD.asp).
In addition to the two development districts, St. Mary’s County also directs development to towns, villages and rural service centers. **Town centers** are the second priority for new development and are intended for mixed use. Permitted uses include residential up to 5 dwelling units per acre and carefully planned commercial (discourages strip centers). Town centers are receiving areas for development rights in the TDR (transfer of development rights) program. Two town centers lie partially within the St. Mary’s River watershed: Hollywood and Piney Point.36

**Village centers** are similar to town centers in many respects and are receiving areas for development rights. New development in village centers is intended to be less intense than in town centers and redevelopment and infill are strongly encouraged.

*Village centers within the St. Mary’s River watershed are: Callaway, Valley Lee, and St. Inigoes.*37

**Rural centers** are intended to accommodate existing commercial development in rural areas. Historically, rural commercial properties were deemed as non-conforming uses, thereby restricting businesses’ abilities to grow and prosper. Current zoning allows these businesses to enlarge and initiate infill development. Rural centers are not receiving areas for development rights.

*Rural centers within the St. Mary’s River watershed are: Dameron, Park Hall, and St. James.*38

Another zoning classification, **rural commercial use**, allows for continuation of certain commercial uses not located within a development district, town, village, or rural service center. At these locations only infill of certain vacant properties zoned C-General Commercial (per Board of County Commissioners Ordinance Z90-11) is permitted where such uses and commercial zoning classifications predate current plans and ordinances. Limited increases in the size and intensity of existing commercial use is permitted. These commercial uses generally will not alter the area’s historic character.39 An example of the rural commercial use is Winter’s Sheet Metal Inc. located on Point lookout Road approximately 1/2 mile north of Chingville Road, and located within the St. Mary’s River watershed.

37ibid, p38.
38ibid, p39.
39ibid.
Workforce Housing Study

The Workforce Housing Study, released in 2007 by the St. Mary’s County Community Workforce Housing Task Force, was prepared for the St. Mary’s County Chamber of Commerce, Governmental Affairs Committee, in response to the need for affordable medium income housing.

Average housing costs in St. Mary’s County increased from 2003 to 2007 by over $130,000. These medium income homes ($300,000 minimum) have become unaffordable for approximately 50% of St. Mary’s residents, limiting the number of people able to live or work in the County.

In 2007, legislation was passed to give communities the authority to provide affordable housing by local trust funds, cost restrictions for resale properties, and require these housing units to be available in subdivisions. The Workforce Housing Task Force then defined workforce housing as being within the 45-110% medium household income with a required salary range.

Objectives:

1. Maintain workforce housing by preserving older neighborhoods
   Allocate funding for the Neighborhood Preservation program and improve public utilities in these neighborhoods. Remove or renovate government-owned dilapidated properties in neighborhoods.

2. Create incentives for developers to construct diverse housing opportunities for a large range of incomes
   Include workforce housing in County’s Zoning Ordinance for affordable housing. Work with developers to incorporate workforce housing into new or existing subdivisions.

3. Increase public awareness and promote State and Federal housing assistance programs and increase public awareness
   Staff a “neighborhood organizer” to coordinate and inform residents of low interest loans or grants for homeownership or house renovation. Federal, state, and private funding for housing initiatives.

4. Establish a source of funding to maintain workforce housing initiatives
   Designate county revenue or develop a foundation to support housing initiatives.

Homelessness

A 3-year plan to address homelessness in St. Mary’s County was prepared by the St. Mary’s County Department of Human Services in 2009, using data from local housing centers. Statistics of the homeless includes those living in emergency, transitional or temporary shelter for a maximum of 2 years. Chronic homeless, are solitary individuals that may have a debilitating illness or have experienced homelessness for over 1 year or 4 periods of homelessness within 3 years.

A 2008 survey taken in the county reported 1,884 sheltered and unsheltered homeless, equaling 883 households with approximately 50 containing dependent children. These individuals represented over 100 chronically homeless, mentally ill and chronic substance abusers. Lesser numbers included veterans and victims of domestic violence.

The strategic plan for the fiscal year of 2010-2013 outlines preventative strategies to reduce and eliminate homelessness, improve

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1 Workforce Housing. 2007. St. Mary’s County Community Workforce Housing Task Force. 14 pages.
emergency services, increase opportunities for transitional and permanent housing, and increase coordination between service providers and departments.

A 2015 survey and focus group study on housing and substance abuse in the area found many continuing issues with housing opportunities and resources for the homeless in the County. Participants and informants’ concerns included high rent costs and insufficient group housing for the County’s homeless. Participants also pointed out that the presence of relatively high-income Airforce Base jobs tends to mask the majority of lower incomes from the larger service industry workforce. This income disparity is particularly a problem in light of concerns about high rent and housing costs.

Shelters

Angel’s Watch Shelter
This shelter is operated and owned by Catholic Charities of the Archdiocese of Washington, DC but provides services for St. Mary’s, Charles, and Calvert County, but is located in Charles County. This shelter specifically offers aid to women and children (up to the age of 17) in need of transitional or emergency shelter, on a first-come, first-served basis. Although bed space is limited, domestic violence cases or during times of inclement weather, the shelter provides extra cots. Those seeking shelter at Angel’s Watch are permitted a 30 day Emergency status during which funding is provided for individuals to demonstrate their ability to move on into transitional or permanent housing. Transitional housing, funded by the Department of Housing and Urban Development, provides services until the individual is self-sufficient.

During 2007, approximately 40% of beds were occupied daily by a St. Mary’s County resident. In 2008, Angel’s Watch sheltered 160 women and children were provided a bed, equaling to 3,824 “bed nights” in that year.

Three Oaks Center
Three Oaks Center, located in Lexington Park, provides emergency, transitional, or permanent housing to men, women, and children from St. Mary’s County. This is the only shelter in the county that houses men. Partnering with local non-profit agencies, Three Oaks Center provides counseling and self-improvement opportunities to residents.

In 2008, Three Oaks Center provided over 70,000 bed nights to 348 men, 341 women, and 430 children. Additionally the Three Oaks Center has a Child Advocacy Program (CAP) that give counseling to families with children to combat behavioral, school, or family problems associated with homelessness.

Leah’s House, Inc.
Leah’s House, which began in 2005 in Valley Lee, Maryland, was the first physical shelter in St. Mary’s County, and provided emergency and transitional housing program for women and children, including domestic violence cases. Leah’s House partners with the Tahirih Justice

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3Health Resources in Action, “St. Mary’s County, MD: Local Qualitative Health Needs Assessment on Substance Abuse Prevention and Response/Opioid Misuse Prevention Assessment,” 2015. Produced for St, Mary’s County Health Department.
Center and provide opportunities for education, counseling, day care, and job search and preparation.

In 2008, 51 individuals were sheltered for 3,335 bed nights with a sizable percentage either gaining permanent or transitional housing, employment, or gained job training or work skills.

St. Mary’s County Department of Social Services
In 2008, the St. Mary’s County Department of Social Services sheltered 265 individuals, including individuals that were referred to other shelters, equaling 8,680 bed nights. The DSS does not provide information on site shelter, but it is the major source in obtaining and funding housing for St. Mary’s County residents elsewhere, including local hotels, Three Oaks Center, and Leah’s House.

New Walden Sierra Site
Walden Sierra is a local, community-based non-profit organization that provides out-patient services to St. Mary’s, Charles, Calvert, and Prince Georges Counties. Walden has been in St. Mary’s County since 1973, and provides treatment for substance abuse, mental health, and recovery services. Located in Lexington Park, Walden, also known as the Hope Place of Walden and Beacon of Hope Recovery Community Center offers counseling, substance prevention, and educational programs.

Faith–Based Homeless Initiative
As of January 2014, after 4 years of service and the participation of over 40 churches and St. Mary’s County WARM (Wrapping Arms ‘Round Many) nights program continues to provide food and shelter to homeless men, women, and children during the winter season. Replicating the Safe Nights Program from Calvert and Charles Counties, this program operates annually from November through March.

Churches that currently participate in this program include:

- All Saints Episcopal
- Church of the Ascension
- Christ Church Episcopal
- Church of Christ
- Cornerstone Presbyterian Church
- Bethesda United Methodist Church
- Beth Israel Synagogue
- Good Samaritan Lutheran Church
- First Missionary Baptist Church
- First Saints Community Church
- Hollywood United Methodist Church
- Holy Angels
- Immaculate Conception
- Immaculate Heart of Mary
- Leonardtown Baptist Church
- Lexington Park United Methodist Church
- Mount Zion United Methodist Church
- New Beginnings Christian Worship
- Oasis of Victory Christian Church International
- Patuxent Presbyterian Church
- Real Life Church
- SAYSF Bible Church
- St. Andrew’s Episcopal Church
- St. Cecilia Church
- St. George’s Episcopal Church
- Trinity Lutheran Church
- Unitarian Universalist Congregation of the Chesapeake
- Zion United Methodist Church

Soup Kitchens

St. Mary’s Caring Soup kitchen, located in Lexington Park, Maryland, is a facility that began in 1993 as Mary’s Song. This community-based non-profit has been functioning for over 10 years, serving free breakfast and lunch, 6 days a week to local people in need. Approximately 1020 meals were provided monthly, free of charge, to men, women, and children during the first three quarters of 2008. These citizens include poor, disabled, elderly, and mentally or physically challenged individuals.

The number of meals served annually has increased substantially over the years, with 18,528 meals provided in 2012, 21,814 in 2013, and 24,744 in 2014. During these years, the number of families visiting St. Mary’s Caring has also increased.

The majority of the food served at St. Mary’s Caring is donated by local churches, day-old food from local grocery stores (day-old food), and individual donations. Additionally, donations of left-over food are provided by St. Mary’s College of Maryland, Harry Lundeberg School, and on occasion local restaurants.

St. Mary’s Caring also offers a summer program, Feed the Families, which provides 10 week’s worth of groceries to the 10 neediest families at Lexington Park Elementary School.

Health and Medicine

The St. Mary’s County Health Department, located in Leonardtown, offers clinical services to the local community. These include education and safety tools for personal health, including providing contraception, testing and treatment for sexually transmitted infections, administering of vaccines/immunizations, screening for breast and cervical cancer. Information about other resources provided by the Health Department is available at http://www.smehd.org/health-clinic/.

Drug addiction and Treatment

St. Mary’s County offers the Prevention Program, which is a substance abuse prevention program whose objective is to reduce risk factors and behaviors that result in misuse of over-the-counter and prescription drugs. Using a community-based approach, the program has self-help resources, educational pamphlets, provides training and workshops, and can give presentations to community groups. These programs include the following:

1. Communities Mobilizing for Change on Alcohol (CMCA)

CMCA is a community program to reduce teen access to alcohol through influencing community policies and practices.

2. Second Step Pre-K

This program, which takes place at the Head Start facilities in St. Mary’s County, is a program for children to learn social and emotional skills in order to reduce aggressive and disruptive behavior.

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7 Maryland Opioid Overdose Prevention Plan. Adopted January 2013. 20 pages
3. Staying Connected With Your Teen (SCT)
   SCT is a five part workshop for parents to gain the tools to provide their child with the means to grow up healthy while being drug and violence-free.

4. Guiding Good Choices (GGC)
   GGC is a five-session educational program for parents with children of age 9-14 to learn how best to reduce the risk of their child developing a drug problem.

5. Opioid Overdose Prevention Workgroup (OOPW) and SMART Medicine Campaign
   The OOPW is a local group that began in 2013 to develop and implement a plan to reduce opioid overdoses by using outreach, education, and awareness programs in the community. The SMART campaign provides information on safe usage of prescription medication.

   A Maryland Opioid Overdose Prevention Plan was created in response to national increases in fatal overdoses from pain killers, or opioid abuse. Over the past decade drug related deaths in Maryland were associated with pharmaceutical opioids and increased over time. Recently, Maryland has experienced a shift from pharmaceutical opioids to heroin, requiring the development of initiatives to assess opioids abuse trends and address public health by altering opioids availability in communities.

   Since 2013, heroin overdose and prescription drug misuse in St. Mary’s County has increased significantly. In March 2014 a Drug Summit was held in St. Mary’s County for a discussion of local drug misuse and prevention and treatment strategies. Information presented during this summit (available at http://healthystmarys.com/wp-content/uploads/2014/03/SMC-Drug-Summit-for-Parents-2014.pdf) discusses the occurrence of lethal and non-lethal prescription medicine overdose cases reported in St. Mary’s County during 2011-2013 (See Table 7-1).

   According to the Department of Mental Health and Hygiene, trends in drug usage reflect those in Maryland with pharmaceutical users shifting to heroin. Heroin cases in St. Mary’s County during the same time period are shown in Table 7-2.

   According to the Walden Behavioral Health opiate addiction in St. Mary’s County is predominantly an issue for 18-30 year olds, and has increased significantly (400% according to State of Maryland Automated Record Tracking (SMART)) from 2008 to 2012. Admission for heroin treatment during this time has more than doubled.

   Other drugs used by the youth in St. Mary’s County have been identified as marijuana, ambien, lunesta, K2/Spice (a mixture of herbs, spices, and plant material), and Purple Drink.

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Table 8-1. Lethal and non-lethal prescription medicine overdose cases reported in St. Mary’s County during 2011-2013.

<table>
<thead>
<tr>
<th>Years</th>
<th>Non-lethal overdose (Adults)</th>
<th>Non-lethal overdose (Juveniles)</th>
<th>Lethal overdose</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>74</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>2012</td>
<td>81</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>2013</td>
<td>71</td>
<td>5</td>
<td>7</td>
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</tbody>
</table>

Table 8-2. Lethal and non-lethal heroin overdose cases reported in St. Mary’s County during 2011-2013.

<table>
<thead>
<tr>
<th>Years</th>
<th>Non-lethal overdose</th>
<th>Lethal overdose</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>2013</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

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strength cough syrup mixed with soda).

Drug treatment and recovery is offered by the Walden Sierra center in St. Mary’s County. More information about Walden facilities can be accessed at http://www.waldensierra.org/programs-services/addiction-services.

**Mental Health Clinics**

St. Mary’s County offers inpatient and outpatient mental health programs, including residential and psychiatric rehabilitation programs, employment support, youth programs, homeless outreach and support, and various other services. This includes Pathways Mental Health agency, which is based in the county, and offers psychiatric treatment and counseling to adolescents and adults. Further information can be found at http://www.pathwaysinc.org/Index.htm. Another county facility is Walden Behavioral, which provides mental health, psychiatric, and crisis services (http://www.waldensierra.org/programs-services/mental-healthtrauma-services).

Walden Behavioral Hope Place in Lexington Park (top) and Cove/DFZ youth center in California (bottom). The California location has three centers which cater to youth, women and men. *Photo credit: Walden-Sierra website.*
Water-based Economies and Businesses

Impacts & Greening

The Maryland Clean Marina Initiative is an effort by the Department of Natural Resources that aids marinas, boatyards, and yacht clubs in pollution prevention. The “Clean Marina” awards program recognizes marinas that follow these steps: take the Clean Marina Pledge, complete a self-evaluation of their facility using the Clean Marina Award Checklist and Guidebook, and are certified by a Clean Marina staff member. Marinas that initially meet the minimum score and are deemed a Clean Marina must annually complete a self-evaluation. To maintain status, a Clean Marina representative must reevaluate the facility every 3 years.

Marinas that receive a Clean Marina status are acknowledged by Maryland Clean Marinas and included in public displays and publications.

The Maryland Clean Marina Guidebook is available digitally at http://dnr.maryland.gov/boating/cleanmarina/cmprogram.asp#guidebook.

Resource Extraction/Usage

Under Governor O’Malley’s 2010 Oyster Restoration and Aquaculture Plan, aquaculture operations are expected to increase within the St. Mary’s River Watershed. As this plan aims to shift commercial production to aquaculture, while also supporting a scientifically managed wild oyster fishery.

Aquaculture existed in the St. Mary’s River decades prior to this plan, but largely ceased when the upper St. Mary’s River, north of Church Point, was designated an Oyster Sanctuary in September of 2010. Only two small lease areas, which were grandfathered in, still remain in the river.

Beginning in 2012, the state opened the sanctuary for additional leasing and several applications are currently under review. Oyster bars in the St. Mary’s River are shown in Map 19.

Marinas

Three marinas are present in the St. Mary’s River watershed: Dennis Point Marina, Milburn Marina, and St. Mary’s College of Maryland Waterfront. All function as areas for boats to be launched or docked.

Dennis Point Marina, located in Drayden, Maryland, at the mouth of Carthagena Creek, offers 80 deep water slips, boat and kayak rental, and has a gasoline dock.

Milburn Marina, off of St. Inigoes Creek, is a significantly smaller marina, only providing docking of approximately 20 small boats. St. Mary’s College of Maryland waterfront, which docks its own skiffs, has a boat launch that is used by the public.

EMPLOYMENT

Milburn Marina on Milburn Cove has sixteen deep water slips. Fuel is no longer available and the store is no longer open. Photo credit: Allison Rugila, May 2015.

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Transportation

Personal transportation in St. Mary’s County is predominantly based on private automobiles, while the transportation of goods is reliant on trucks or horse-drawn carriages, both using the same public highways and roads. The St. Mary’s Transit System, which has also experienced an increase in users, allows for individuals to travel throughout the county. As the St. Mary’s County’s population has grown, the highways have become increasingly congested, particularly on Three Notch Road corridor during peak hours.

In 2006 St. Mary’s County Transportation Plan was used to identify improvements that could be made to various transportation resources, including roadways, public transit, bicycle paths, trails, and sidewalks to sustain the projected demand until 2025. Improvements made would result in a more accessible transit resource for older adults, people with disabilities, and people with lower incomes.

Additionally, the county adopted a 5-year Transportation Development Plan (TDP) in 2007, to address the transit needs identified in census data, transit rider surveys, and input from stakeholders. This adjusted the fare for transit and adjusted the stops, divided the Leonardtown-Lexington Park Route into two separate routes, and increased the frequency of stops in the Great Mills Loop.

The St. Mary’s County, Maryland Comprehensive Plan (2010) proceeded to encouraged mixed-use transportation, by promoting biking and walking through the development of pedestrian infrastructure in high traffic areas, Lexington Park and Leonardtown.

Three Notch Trail

The Three Notch Trail project, which is a County-owned Railroad that was paved for use as a non-motorized pedestrian and bicycle trail. This trail would connect the Patuxent River Naval Air Station in Lexington Park north into Hughesville, Charles County. This trail provides a recreational and transportation corridor, connecting businesses, historical sites, parks, senior centers, farmers markets and libraries. The construction of this trail will be completed in 8 phases, of which I, II, III, IVA, and V have been completed. Phases IVB, VI, VII, VIII, and IX are planned for construction in 2015, permitting funding. See Figure 7-1 for areas located in each phase.

Bike Clubs

- PAX Velo Bicycle Racing Club
- Patuxent Area Cycling Enthusiasts (PACE)
- Oxon Hill Bicycle and Trail Club

Paddle clubs

- Southern Maryland Paddlers

Kayak/Canoe and Boat Launch Areas

St. Mary’s River watershed offers county owned and operated public landings. These include:

- St. Mary’s River State Park, Boat and Soft Launch
- Great Mills Canoe/Kayak Launch
- St. George’s Island Landing (pier access only)
- Piney Point Landing

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Figure 8-1. Completed and future phases of Three Notch Trail, St. Mary’s County, MD.
Point Source Discharges—Sewerage and Landfills

Discharges from pipes or other discrete conveyances are called point source. Point sources may contribute pollution to surface water or to ground water. For example, wastewater treatment plant discharges may contribute to nutrient or microbes that consume oxygen measured as Biochemical Oxygen Demand (BOD). The BOD reduces the oxygen supply available for aquatic life where discharge occur. Industrial point sources may contribute various forms of pollution. Some understanding of point source discharges in a watershed can be useful in helping to identify and prioritizing potential restoration measures.

In the St. Mary’s River watershed, there are several permitted point source discharges based on information from the Maryland Department of the Environment (also shown in Map 8).

- The Webster Field Sewage Treatment Plant is the only treatment plant discharging directly into the St. Mary’s River. The plant is permitted for a capacity of 45,000 gallons per day. The plant handles the domestic waste generated on the Navy’s Webster Field facility. (Permit No. NPDES #MD0020095)

- The St. Andrews Municipal Landfill is also located in the watershed. The landfill is currently not in operation; however there is an open permit to expand the filling activities in the future if the need arises. (Permit No. 2005-WMF-0138)

- The Knott Land Clearing Debris Landfill is permitted by the Maryland Department of the Environment and is located ¼ of a mile north of the intersection of Flat Iron Road and Booth Road in Great Mills, MD. (Permit No. 2006-WLC-0134)

Other large industrial and institutional sites in the watershed are:

- Valero Petroleum Company’s transshipment and storage facility. The facility is of regional importance since it supplies petroleum to the Washington D.C. area.

- The Harry Lundeberg School of Seamanship is also located within the St. Mary’s River drainage area. The school specializes in providing vocational training to those persons seeking a career in Merchant Marines.
A large portion of the St. Mary’s River watershed lies within the St. Mary’s County Metropolitan Commission’s Sanitary Districts #5 (Piney Point) and #8 (Lexington Park). The lower eastern shore of the St. Mary’s River is within the Sanitary District #7 which is not served by public facilities at this time. The public sewage collection system in these areas directs the sewage to the Marlay Taylor Water Recovery Facility and after treatment the effluent is discharged into the Chesapeake Bay. There were 55 pumping stations in St. Mary’s county in 2012. Those pump stations are shown in Table 7-3.


<table>
<thead>
<tr>
<th>Station Name</th>
<th>CY2006 Average Daily Flow, MGD</th>
<th>Maximum Design Daily Flow, MGD</th>
<th>Number of Pumps</th>
<th>Capacity of Each Pump</th>
<th>Force Main Diameter, inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estoom Bay</td>
<td>0.040</td>
<td>0.105</td>
<td>2</td>
<td>98</td>
<td>3</td>
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<td>Rosebank</td>
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<td>0.020</td>
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<td>Globe Pt</td>
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<td>0.161</td>
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<td>Villages of Leonardtown</td>
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<td>0.046</td>
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<td>McIntosh (Town operated)</td>
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<td></td>
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<tr>
<td>Leonardtown #2</td>
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<td>0.144</td>
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<td>Wharf (Town operated)</td>
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<td>Piney Point Landings</td>
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<td>Bradley Boulevard</td>
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8-11
### Table 8-3, cont.

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<th>Station Name</th>
<th>CY2006 Average Daily Flow, MGD</th>
<th>Maximum Design Daily Flow, MGD</th>
<th>Number of Pumps</th>
<th>Capacity of Each Pump</th>
<th>Force Main Diameter, Inches</th>
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</tr>
<tr>
<td>Greensbrier</td>
<td>0.650</td>
<td>0.486</td>
<td>2</td>
<td>450</td>
<td>8</td>
</tr>
<tr>
<td>Hickory Hills</td>
<td>0.034</td>
<td>0.391</td>
<td>2</td>
<td>325</td>
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</tr>
<tr>
<td>Hilton Run</td>
<td>0.054</td>
<td>0.291</td>
<td>2</td>
<td>273</td>
<td>8</td>
</tr>
<tr>
<td>Hunting Quarters</td>
<td>0.037</td>
<td>0.324</td>
<td>2</td>
<td>306</td>
<td>6</td>
</tr>
<tr>
<td>Laurel Glen</td>
<td>0.016</td>
<td>0.086</td>
<td>2</td>
<td>80</td>
<td>4</td>
</tr>
<tr>
<td>Lynn Drive</td>
<td>0.051</td>
<td>0.270</td>
<td>2</td>
<td>250</td>
<td>4</td>
</tr>
<tr>
<td>Meadow Lake</td>
<td>0.026</td>
<td>0.216</td>
<td>2</td>
<td>194</td>
<td>4</td>
</tr>
<tr>
<td>Moorings</td>
<td>0.010</td>
<td>0.086</td>
<td>2</td>
<td>80</td>
<td>4</td>
</tr>
<tr>
<td>Patuxent Park West</td>
<td>0.027</td>
<td>0.259</td>
<td>2</td>
<td>240</td>
<td>6</td>
</tr>
<tr>
<td>Peggs Road</td>
<td>0.001</td>
<td>0.099</td>
<td>2</td>
<td>92</td>
<td>6</td>
</tr>
<tr>
<td>Pembroke</td>
<td>0.001</td>
<td>0.546</td>
<td>2</td>
<td>600</td>
<td>8</td>
</tr>
<tr>
<td>Pickett’s Harbor</td>
<td>0.012</td>
<td>0.116</td>
<td>2</td>
<td>107</td>
<td>4</td>
</tr>
<tr>
<td>Planters Court</td>
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<td>0.130</td>
<td>2</td>
<td>126</td>
<td>4</td>
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<tr>
<td>Riverbay</td>
<td>0.040</td>
<td>0.226</td>
<td>2</td>
<td>209</td>
<td>6</td>
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<td>Rue Woods</td>
<td>0.006</td>
<td>0.072</td>
<td>2</td>
<td>67</td>
<td>4</td>
</tr>
<tr>
<td>St. Mary’s City</td>
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<td>0.613</td>
<td>2</td>
<td>566</td>
<td>10</td>
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<tr>
<td>St. Mary’s Industrial Park</td>
<td>0.023</td>
<td>0.316</td>
<td>2</td>
<td>292</td>
<td>10</td>
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<tr>
<td>St. Mary’s Square</td>
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<td>0.162</td>
<td>2</td>
<td>150</td>
<td>4</td>
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<tr>
<td>Southgate</td>
<td>0.015</td>
<td>0.070</td>
<td>2</td>
<td>65</td>
<td>4</td>
</tr>
<tr>
<td>Spring Valley</td>
<td>0.109</td>
<td>0.270</td>
<td>2</td>
<td>250</td>
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<tr>
<td>Waters Edge</td>
<td>0.028</td>
<td>0.157</td>
<td>2</td>
<td>145</td>
<td>4</td>
</tr>
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<td>Westbury</td>
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<td>0.363</td>
<td>2</td>
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<td>6</td>
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<tr>
<td>Widgeen</td>
<td>0.008</td>
<td>0.045</td>
<td>2</td>
<td>42</td>
<td>2</td>
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<tr>
<td>Wildwood #1</td>
<td>0.161</td>
<td>0.655</td>
<td>2</td>
<td>588</td>
<td>8</td>
</tr>
<tr>
<td>Wildwood #2</td>
<td>0.110</td>
<td>0.382</td>
<td>2</td>
<td>354</td>
<td>8</td>
</tr>
<tr>
<td>Wildwood #3</td>
<td>0.101</td>
<td>0.287</td>
<td>2</td>
<td>366</td>
<td>4</td>
</tr>
<tr>
<td>Willow Woods</td>
<td>0.006</td>
<td>0.045</td>
<td>2</td>
<td>40</td>
<td>2</td>
</tr>
</tbody>
</table>
Ground Water and Water Supply—Aquifers

Potable water is supplied through three confined aquifers throughout St. Mary’s County. They are the Piney Point, Aquia, and Upper Patapsco. Sporadic use, mostly for agriculture, is supplied by a fourth unconfined aquifer, the surficial aquifer commonly referred to as the water table. This source is generally not reliable in drought years or seasonally. The surficial aquifer may contain contaminants. Historically, hand-dug wells into the surficial aquifer were used for potable usage. Over time and through extensive Federal water projects in the 1940s, these wells have been replaced with public water supplies or modern wells drilled into the Piney Point or Aquia. It is not known how many, if any, of these wells that supply drinking water are still in existence.

Figure 7-2 depicts the aquifers and the separating clay layers, which inhibit the movement of ground water. Shown from highest to lowest elevation, they are the surficial, Piney Point, Aquia, Upper Patapsco, Lower Patapsco, and Patuxent. Below the Patuxent is bedrock and it is not considered to be a significant water supply. The aquifers and confining units are sloped downward from northwest to southeast, thus allowing the northwest end of each aquifer to subcrop (extend to the land surface) and mix with the surficial aquifer. These areas allow surface water to enter each of the confined aquifers and recharging water supplies. Confined aquifers are under pressure from the weight of the land and water causing the water to rise in height within wells to a level somewhat above the top of the aquifer at each well location. This water level is referred to as the potentiometric surface.

The Maryland Department of the Environment regulates water withdrawal from aquifers. When potentiometric surface levels reach a point 80% below the land surface and the top of the aquifer, additional withdrawals are curtailed. Withdrawal below this level may cause land subsidence, reduced productivity, and/or brackish water intrusion.

The Piney Point aquifer, known in some research reports as the Nanjemoy or Piney Point Nanjemoy, subcrops in central Charles and Calvert counties. It is primarily used for private domestic water supply for older homes in the Lexington Park development district and homes in rural areas of the St. Mary’s River watershed. Water supplies from the Piney Point aquifer are high quality and generally contain only trace amounts, if any, of arsenic. The Piney Point aquifer is available throughout the St. Mary’s River watershed.

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13 ibid, p3.
The Aquia aquifer is separated from the Piney Point aquifer by the Marlboro Clay confining layer. This aquifer is used extensively for domestic and major-user supplies in southern Maryland, as well as in Virginia and the Eastern Shore of Maryland (as seen in Map 10). It is also used by commercial, industrial, and military users within the watershed. The Aquia aquifer subcrops in northwestern Charles County. It is available throughout the St. Mary’s River watershed (it is not productive in southern St. Mary’s County).

Water quality in the Aquia aquifer is generally good, except naturally occurring arsenic concentrations exceed the new U.S. Environmental Protection Agency Maximum Contaminant Level (MCL) of 10 micrograms per liter (μg/L) (Federal Register, 2001) for public water supplies. For this reason, expansion of public water resources are supplied by the Patapsco. Existing water supplies in the Aquia aquifer not meeting the new MCL are being terminated and replaced by the Patapsco. Lowered potentiometric surface in excess of 220 feet form a deep cone of depression in the Lexington Park area due to heavy withdrawals. (see Figure 33) Levels dropped more than 90 feet in the 1990s.

The Upper Patapsco and Lower Patapsco aquifers are believed to have some localized exchange of water. Within each aquifer there are complex stratified sandy units separated locally by silty sand and clayey units. These sands appear to be interconnected at a regional scale to form a single aquifer.

Recharge of the Patapsco aquifer is at or near

![Figure 8-3](image-url) Hydrographs showing long-term potentiometric surface trends in Lexington Park aquifers. Source: Drummond, 2005, p35.

16 ibid, p5.
17 ibid, p5,7.
to the fall line or along Interstate 95. Salt water intrusion at Indian Head is believed to be due to a cone of depression allowing the interconnection between the subcrop area and the Potomac River. Potentiometric surface of the Upper Patapsco in Lexington Park has dropped 37 feet since 1983.\textsuperscript{17} Water quality in the Patapsco is very good and no arsenic has been detected.

The Patuxent aquifer lies on bedrock and is the deepest aquifer in southern Maryland. A test well in Lexington Park supplied brackish water, therefore, the Patuxent aquifer is not considered a source of potable water.\textsuperscript{18}

A fourth confined aquifer, the Magothy regionally located between the Aquia and the Upper Patapsco, does not extend into the St. Mary’s River watershed area.

Effects of falling potentiometric surface can negatively affect private wells. Wells have been constructed with 4-inch diameter casings near to the land surface to accommodate a submersible pump, but reduce to 2-inch diameter below that to save on construction costs. These are referred to as telescoping wells. Drummond writes, “If the potentiometric level falls below the reduction point (or near to the reduction point due to pump drawdown) in such a well, the pump cannot be lowered further and the well must be replaced. … [this] may cause significant economic impact in areas where telescoping wells are common.”\textsuperscript{19}

Within the St. Mary’s River watershed area the effects of withdrawals and lower potentiometric surface of the Aquia generally have no effect on the water table.\textsuperscript{20} A lowered water table may include reduced base flow to streams, a decrease in water available for plant transpiration, and altered ecology of wetlands.\textsuperscript{21} These processes are complex and localized, and were not addressed in the June 2005 Drummond study. Additionally, excessive drawdown may invite river water or Bay water intrusions; this effect noted currently in the Indian Head area for the Upper Patapsco.

According to the June 2005 Drummond study, future pumping trends in the St. Mary’s River watershed and the Lexington Park area do not anticipate any significant negative effects to the three confined aquifers through the year 2030.\textsuperscript{22} As the public supply continues to limit additional pumping in the Piney Point and Aquia, potentiometric surface lowering should decrease. Increased use of the Patapsco was studied according to land use regulations at the time. Recently, the county adopted new rules for designated growth patterns (Annual Growth Policy, August 19, 2008), which may increase development pressure in the Lexington Park development district and cause further lowering of potentiometric surface than Drummond’s model projected. Likewise, the Drummond model did not anticipate any new major users (industrial, agricultural, military, or extraction).

\textsuperscript{17} Drummond, David D., “Water Supply Potential of the Coastal Plain Aquifers in Calvert, Charles, and St. Mary’s Counties, Maryland, with Emphasis on the Upper Patapsco and Lower Patapsco Aquifers.” Maryland Department of Natural Resources Resource Assessment Service, June 2005, p7.
\textsuperscript{18} Hansen, H. J., and Wilson, J. M., 1984, Summary of hydrogeologic data from a deep (2,678 ft.) well at Lexington Park, St. Mary’s County, Maryland: Maryland Geological Survey Open-File Report No. 84-02-1, p61.
\textsuperscript{19} Drummond, June 2005, p8.
\textsuperscript{20} ibid, p. 8
\textsuperscript{21} Drummond, June 2005, p 8
\textsuperscript{22} Drummond, June 2005, p. 17
The public water system is operated by the St. Mary’s County Metropolitan Commission and utilizes water supplied through confined aquifers. The production wells for this system are screened in three unconfined aquifers. Ranging from shallowest to deepest these are the Piney Point, Aquia, and Patapsco Aquifers. Most of the wells are screened in the Aquia Aquifer (16 wells), while the Patapsco (5 wells) and the Piney Point (3 wells) aquifers feature significantly fewer wells. A similar ratio is exhibited for the well population supporting the small community systems. Presently the St. Mary’s County Metropolitan Commission operates 24 production wells in the Lexington Park system with a total average pumping capacity of about 220 gallons per minute per well across a range of 55 to 600 gallons per minute. Independent of the public system, more than 35 small community systems (trailer parks, developments, military bases) operate 104 wells to meet the local demand in St. Mary’s County. METCOM has removed service from wells due to arsenic, replacing that service with wells in the Patapsco.

The public wells in the Lexington Park area are shown in Table 7-4.

Table 8-4. Public wells in Lexington Park area, St. Mary’s County, MD. Source: St. Mary’s County Metropolitan Commission, 2009.

<table>
<thead>
<tr>
<th>Well</th>
<th>Pump Flow Rate</th>
<th>Aquifer</th>
<th>MDE Allocation*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abberly Farms</td>
<td>450</td>
<td>Patapsco</td>
<td>450</td>
</tr>
<tr>
<td>Bank Square</td>
<td>270</td>
<td>Aquia</td>
<td>1010</td>
</tr>
<tr>
<td>Colony Square</td>
<td>170</td>
<td>Aquia</td>
<td>1010</td>
</tr>
<tr>
<td>Espranza Farms</td>
<td>140</td>
<td>Aquia</td>
<td>1010</td>
</tr>
<tr>
<td>Essex Drive</td>
<td>140</td>
<td>Aquia</td>
<td>100</td>
</tr>
<tr>
<td>First Colony #1</td>
<td>220</td>
<td>Patapsco</td>
<td>330</td>
</tr>
<tr>
<td>First Colony #2</td>
<td>300</td>
<td>Patapsco</td>
<td>330</td>
</tr>
<tr>
<td>Great Mills</td>
<td>140</td>
<td>Piney Point</td>
<td>140</td>
</tr>
<tr>
<td>Greenbrier #1</td>
<td>450</td>
<td>Patapsco</td>
<td>80</td>
</tr>
<tr>
<td>Greenbrier #2</td>
<td>280</td>
<td>Aquia</td>
<td>30</td>
</tr>
<tr>
<td>Greenvlew Knolls #3</td>
<td>120</td>
<td>Aquia</td>
<td>60</td>
</tr>
<tr>
<td>Hickory Hills</td>
<td>55</td>
<td>Aquia</td>
<td>10</td>
</tr>
<tr>
<td>Laurel Glen</td>
<td>200</td>
<td>Aquia</td>
<td>40</td>
</tr>
<tr>
<td>Pegg Road</td>
<td>435</td>
<td>Aquia</td>
<td>1010</td>
</tr>
<tr>
<td>San Souci</td>
<td>120</td>
<td>Aquia</td>
<td>1010</td>
</tr>
<tr>
<td>St. Mary’s Industrial Park</td>
<td>350</td>
<td>Patapsco</td>
<td>240</td>
</tr>
<tr>
<td>Town Creek #3</td>
<td>115</td>
<td>Piney Point</td>
<td>140</td>
</tr>
<tr>
<td>Town Creek #6</td>
<td>145</td>
<td>Piney Point</td>
<td>140</td>
</tr>
<tr>
<td>Tubman Douglas</td>
<td>60</td>
<td>Aquia</td>
<td>30</td>
</tr>
<tr>
<td>Wildwood #1</td>
<td>85</td>
<td>Aquia</td>
<td>240</td>
</tr>
<tr>
<td>Wildwood #2</td>
<td>80</td>
<td>Aquia</td>
<td>240</td>
</tr>
<tr>
<td>Wildwood #3</td>
<td>120</td>
<td>Aquia</td>
<td>240</td>
</tr>
<tr>
<td>Wildwood #4</td>
<td>600</td>
<td>Aquia</td>
<td>600</td>
</tr>
<tr>
<td>Willow Road</td>
<td>140</td>
<td>Aquia</td>
<td>1010</td>
</tr>
</tbody>
</table>

*Note: Flow Rate and MDE Allocation given in gallons per minute
**Hazard Mitigation Plan**

The St. Mary’s County Board of Commissioners adopted the St. Mary’s County Multi-Jurisdictional Hazard Mitigation Plan in 2011. This plan was required by the Disaster Mitigation Act of 2000, requiring a plan to be adopted by state and local governments. This plan, produced by the Department of Public Safety and Information Technology, established an ongoing hazard mitigation planning program to reduce or eliminate long-term risks to people and property.

**Emergency Evacuation Plan**

Citizens Are Ready for an Emergency (CARE) is a hazard guide to preparing for emergency events. This guide was prepared by the St. Mary’s County Department of Public Safety and adopted by the St. Mary’s County Commissioners in 2007. CARE is intended for public use and outlines how to design a Family Emergency Plan, assemble an Emergency Supply Kit, and address issues such as power outages, chemical threats, floods, other natural disasters. This guide also contains a compiled list of emergency contact numbers and other sources for information.

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Growing for Local Consumers

St. Mary's county contains three farmers markets, two of which operate within the watershed. The markets are evenly spread across the population centers: "Home Grown Farm Market" runs out of Lexington Park, the California Farmers Market operates in the BAE parking lot, just north of the Naval base, and "North St. Mary's Farmers Market" is located at the Charlotte Hall Library.

Farmers markets promote locally available produce, provide consumers with the option to select organic, more sustainable produce as compared to large-scale food production corporations. Each unique market attracts farmers and small business owners from the local area, creating an efficient farm-to-table system.

Other gardening initiatives include the local college, Public and Charter Schools, including the Chesapeake Public Charter School. The St. Mary’s College of Maryland Campus Farm, which began in 2010, supplies fresh produce to the local homeless shelter and the school food service, Bon Appetit. In addition, the Chesapeake Bay Charter School maintains a functioning garden.

Home and Backyard Composting

Composting is the decomposition of organic material, typically food waste, through the use of naturally occurring organisms in soil. An average household disposes of 474 pounds of food waste every year, while businesses throw away up to 90% of their food waste, approximately 26 million tons a year. Backyard composting is a relatively easy method for reducing the amount of waste requiring disposal and cost-effectively use this waste by incorporating this nutrient rich commodity into your soil. To compost food waste at home, mix food with shredded paper and yard waste. For more information about the do’s and don’ts of composting visit the St. Mary’s County Recycling Program website: http://www.co.saint-marys.md.us/dpw/recycleprogramslist.asp.

St. Mary’s County also composts annually at the local landfill.

Farms and Farmland

U.S. Department of Agricultural 2012 census identified 632 farms in St. Mary’s County, averaging 106 acres per farm and accounting for 67,086 acres of land. Crop production in St. Mary’s County primarily consists of corn and wheat. The following tables show acreage, the number of farms and quantities of animals associated with the St. Mary’s County Agricultural sector.

According to the St. Mary’s County Comprehensive plan, agriculture in the county has shifted largely due to the So. Maryland, So Good program, encouraging demand for local produce and goods.

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Animal Operations

Three plans—the Tributary Strategies plan, Maryland Nutrient Management Plan, and the Water Quality Improvement Act of 1998—all address nutrient management, particularly from farm areas and animal feeding operations (AFOs).25 Free services for farmers are offered under the MNMP, including yield goals and nitrogen recommendations for crops, soil nitrate testing for corn, as well as manure testing procedures; these services allow farmers to tailor fertilizer applications and manure management for optimal yields and minimal nutrient contribution to local waterways.

Agricultural Best Management Practices (BMPs) are encouraged for farmers to reduce nutrient leaching and erosion on their properties. The Maryland Nutrient Management Manual for farmers can be found at http://mda.maryland.gov/resource_conservation/Pages/nm_manual.aspx.

Several programs exist to promote landowner participation in fencing, manure management, and other practices to capture runoff. The Conservation Reserve Enhancement Program (CREP) offers incentives for farmers to implement BMPs in partnership with state government (see section 8 for more discussion on conservation and restoration plans). Other incentives for agricultural BMP implementation are given through the Maryland Agricultural Water Quality Cost-Share (MACS) program.26

Equine Facility Needs & Impacts

In 2012, the Equine sector in St. Mary’s County included 197 farms and 1,286 horses and ponies. Traditionally, horse farms have managed manure and stall waste through spreading it on hay fields and pastures.27 However, this method can lead to excess leaching of nutrients into waterways. Horse farms are now required to develop nutrient management plans, fencing and setbacks from waterways, and BMP implementations on horse farms are

Table 8-5. St. Mary’s County farmland use and acreage from the U.S. Department of Agriculture 2012 Census.

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Number of Farms</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cropland</td>
<td>532</td>
<td>41,216</td>
</tr>
<tr>
<td>Woodland</td>
<td>410</td>
<td>17,340</td>
</tr>
<tr>
<td>Permanent Pasture/Rangeland</td>
<td>284</td>
<td>4,066</td>
</tr>
<tr>
<td>Land for buildings, roads, wastelands, etc.</td>
<td>450</td>
<td>4,464</td>
</tr>
<tr>
<td>Pastureland</td>
<td>338</td>
<td>6,263</td>
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<tr>
<td>Conserved land</td>
<td>55</td>
<td>1,410</td>
</tr>
</tbody>
</table>

Table 8-6. St. Mary’s County livestock and poultry farms and their relative totals from the U.S. Department of Agriculture 2012 Census.

<table>
<thead>
<tr>
<th>Livestock/Poultry</th>
<th>Number of Farms</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle/Calves</td>
<td>191</td>
<td>3706</td>
</tr>
<tr>
<td>Beef Cows</td>
<td>125</td>
<td>1556</td>
</tr>
<tr>
<td>Milk Cows</td>
<td>49</td>
<td>304</td>
</tr>
<tr>
<td>Hogs/Pigs</td>
<td>45</td>
<td>854</td>
</tr>
<tr>
<td>Sheep/Lambs</td>
<td>52</td>
<td>856</td>
</tr>
<tr>
<td>Egg-laying Chickens</td>
<td>129</td>
<td>5882</td>
</tr>
<tr>
<td>Meat-birds</td>
<td>18</td>
<td>18012</td>
</tr>
</tbody>
</table>

RESTORATION AND CONSERVATION TARGETING

Upper St. Mary’s River Baseline Watershed Assessment - November 2001

This study resulted in recommendations to limit impervious surfaces and to make storm water management retrofits.

Policies: Direct Growth to already degraded catchments (>10% impervious surfaces) while maintaining good conditions where they exist in others (<10%).

Actions: Storm Water Management Retrofits: Identify and provide improvements to existing storm water retention, infiltration, bioretention and other facilities and conveyance systems. Prioritize the retrofits by catchment quality.

Army Corps of Engineers 2009 Reports

Several well-known programs and tools exist to implement goals for watershed restoration and protection. Several of these programs have been utilized in and for the St. Mary’s watershed since 2001. These programs have resulted in the publication of five (5) specific documents as detailed below which contain generalized goals and objectives for restoration and/or conservation as well as more specific actions including public policy implementation and physical on-the-ground actions. This section will identify, by study, those policies and physical activities. These are referenced in many cases to either print or digital GIS resources available at the St. Mary’s County Department of Land Use and Growth Management (LUGM) which identify our target restoration and conservation efforts.

1 Catchment GIS maps can be viewed at the St. Mary’s County Department of Land Use and Growth Management.
2 Retrofit GIS location maps can be viewed at the St. Mary’s County Department of Land Use and Growth Management.
This report describes the specific process of locating, identifying and prioritizing potential storm water retrofit sites for the Upper St. Mary’s, Jarboesville, Hilton and Pembrooke Run subwatersheds as advocated in the Baseline Assessment. The report uses a retrofit implementation strategy and concludes with a detailed recommendation for 28 candidate sites and an appendix of retrofit inventory sheets, site detail descriptions and conceptual sketches of a likely retrofit option for each. The report further defines “Tier 1, 2 and small scale change” priorities.

Table 9-1. Tier 1 and Tier 2 Candidate Retrofit Sites. Information provided by Feasibility study, Figure 6, Page 10.
This Technical Memorandum follows the Baseline Assessment to conduct detailed field assessment of stream channel and floodplain conditions along 30 miles of non-tidal streams. The study identifies three (3) parameters (stream condition impairment, biological quality and future land use (catchment impervious surface) to gauge stream reach restoration priorities. The study concludes with a three (3) tiered restoration priority ranking for 15 reaches. Focus again is on high quality reaches with the greatest potential to succeed given a projected land development scenario. The 15 restoration priority reaches are given in Table 8-2, provided by the Technical Memorandum.

Table 9-2. Restoration priority based upon reach impairment, biological quality, and future land use. Information provided by Technical Memorandum, Table E-7.

<table>
<thead>
<tr>
<th></th>
<th>1st Priority</th>
<th>2nd Priority</th>
<th>3rd Priority</th>
</tr>
</thead>
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<tr>
<td></td>
<td>Stream Condition Impairment</td>
<td>Biological Quality</td>
<td>Future Catchment Impervious Cover***</td>
</tr>
<tr>
<td>JR101*</td>
<td>slight</td>
<td>Good</td>
<td>High</td>
</tr>
<tr>
<td>H201</td>
<td>slight</td>
<td>Good</td>
<td>Medium</td>
</tr>
<tr>
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<td>Good</td>
<td>Low</td>
</tr>
<tr>
<td>JC101</td>
<td>slight</td>
<td>Good**</td>
<td>Low</td>
</tr>
<tr>
<td>JC102*</td>
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<td>Good**</td>
<td>Low</td>
</tr>
<tr>
<td>JC201</td>
<td>slight</td>
<td>Good</td>
<td>Low</td>
</tr>
</tbody>
</table>

* RTE species present
** predicted biological quality
*** Future Catchment Impervious cover is rated as:
  High >30%
  Medium 15-25%
  Low <15%
Natural Resources Conservation Summary for St. Mary’s County, Maryland – September 2002

This document presents an inventory of potential conservation resources for 1) Rare, Threatened and Endangered (RTE) species; 2) Contiguous Forest Resources; 3) Wetland areas; and 4) other wildlife and habitats in need of conservation. The document is intended for use by planners and development plan reviewers to quickly evaluate potential impacts on or near proposed development sites.

The inventory concludes that one of two specific areas in the county that support a diversity of plant and animal species and important habitats is in the upper St. Mary’s River watershed in the St. Mary’s River Bottomland and St. Mary’s River Fish Management Area. While these areas are predominantly within St. Mary’s River State Park, additional conservation actions could be directed to those otherwise unprotected areas. Figure 8-1 identifies the location within the watershed of the Bottomland and Fish Management Area.

Figure 9-1. St. Mary’s River Watershed, Bottomland and Fish Management Area.
This study used a multi-faceted approach to analyze the ability of the lower Potomac River basin and its tributaries to support SAV and oyster restoration projects. GIS analysis of site selection criteria from literature reviews, expert interviews, historic data and water quality and physical data resulted in recommendations for both SAV and oyster restoration projects in designated areas of the St. Mary’s River.

SAV restoration is recommended in specific narrow one meter depth contour areas in the upper river.

Figure 8-2 from the study identifies the location of recommended SAV restoration sites.

Figure 9-2. Location of Recommended SAV Restoration Sites.
Oyster restoration is recommended in the lower portion of St. George's Creek opposite Piney Point and south. Map 8-3 from the study identifies the location of recommended oyster restoration sites. Additional policies, programs and restoration actions are detailed in the following sections.

Figure 9-3. Location of Recommended Oyster Restoration.
2007 VIMS Performance of SILS

An assessment of living shorelines and their function in erosion mitigation in the Chesapeake Bay was conducted by the Center for Coastal Resources Management at the Virginia Institute of Marine Science (VIMS). The report, The Stability of Living Shorelines: An Evaluation, was submitted to the National Oceanic and Atmospheric Administration (NOAA) in 2007.\(^3\)

The objective of this study was to use statistical data to analyze the effect of tidal marshes on the environmental conditions of tidal shorelines. The study found that living shorelines were present more frequently in areas with adequate erosion control while areas without living shorelines did show significant erosion problems. No significant differences were found between erosion rates in experimental treatments, but evidence from the study confirmed that erosion can be reduced using “soft stabilization techniques.”

Additionally, the study found that the presence of artificial erosion prevention structures, such as bulkheads, negatively impacted the growth and formation of tidal marshes. Living shorelines were also found to be unsuccessful in areas with high energy environments, and therefore marshes have limited use in these high-energy areas.

Using a GIS database, a spatial model was developed to determine what areas may require living shorelines to reduce erosion. The model results were compared to field surveys in order to identify site suitability for living shorelines. The model showed significant potential, with 75% of its predictions in agreement with the field surveys. This model may be a promising tool in determining future shoreline management strategies, if data is available for the region in question.

Conservation Programs

Agricultural Conservation Programs

The St. Mary’s County Comprehensive plan has identified a goal of preserving 60,000 acres of farmland by 2020. A minimum of 80% undeveloped land is to be in the Priority Preservation Area. This goal will be achieved with state and county funding to provide incentives and implement regulations for non-farm development. See Map 14 for lands protected by easements.

Rural Legacy Areas

Mattapany Rural Legacy Area (MRLA) in St. Mary’s County was sponsored in 2006 by the Patuxent Tidewater Land Trust, and encompasses 13,703 acres of farmland, forests, wetlands, historic sites, and wildlife habitat. This area facilitates the protection of the St. Mary’s River watershed and Chesapeake Bay water quality, and provides an open space buffer for the Naval Air Station Patuxent River. 8,500 acres are intended to be protected with funding from Rural Legacy. The Fenwick property was the first preserved MRLA, accounting for 155 acres. An additional 3 properties adjacent to Fenwick were purchased by the end of 2009 (totaling 2,536 acres).

Conservation Reserve Enhancement Program

Maryland’s CREP, which began in 1997, is an environmental incentive program for landowners to restore and/or preserve sensitive areas on their property, including stream buffers, wetlands, and erodible soil, thereby reducing nutrient inputs and improving habitat quality. Additionally, CREP participants are given a payment in return for 10 to 15 years of preserving the property (i.e. taking it out of production and maintaining vegetation listed in the CREP contract).

CREP payment methods include:

1. One-time payment of a maximum of $200 per acre of land listed in the program.
2. Annual rental payment consisting of the soil rental rate in addition to a per acre incentive (80-200% soil rental rate).
3. Cost-share (up to 87.5% reimbursed) to implement best management practice.
4. One-time incentive payment (40% cost of installing BMP) in addition to cost-share.
5. Annual rental payments and up to $7 per acre for land management.

Figure 9-4. Mattapany Rural Legacy Area. Courtesy of Maryland Department of Natural Resources.

Conservation Programs continued

Agricultural Conservation Programs, continued

Conservation Easement Programs

Agricultural conservation easements account for a large part of Maryland’s preserved agricultural and rural land. Easements are donated by landowners and involve the landowner giving up most or all of their development rights, while still retaining ownership of the land. Easements are permanent, so the development restrictions persist on preserved land through all changes in ownership.

Three major programs exist for conservation easements of farmland in the County: the Maryland Agricultural Preservation Foundation, the Maryland Environmental Trust, and the Maryland Historical Trust.

St. Mary’s County began participating in the MALPF program in 1995, with the goal to permanently protect 60,000 acres of farmland. As of 2009, 13,911 acres were permanently protected in St. Mary’s County through easements; 8,665 acres through MALPF, 2,860 acres through the Rural Legacy Program, 2,083 through the Maryland Environmental Trust, and 303 acres through the Maryland Historical Trust.

Specific policy guidelines regarding land preservation can be found in the St. Mary’s County Comprehensive Plan.6

Energy Conservation

Solar power

St. Mary’s County Public Schools, through the Green Schools Program, committed to renewable energy by applying and receiving a $500,000 grant from the Maryland Energy Administration’s Project Sunburst.7 The County Public Schools installed large scale solar photovoltaics at the George Washington Carver Elementary School (GWCES), producing 80% of the annual electric consumption at the school. As of 2012, GWCES generated enough energy to completely support its own energy needs. Over the 15 years the photovoltaic system is under the power purchase agreement, the County Public Schools will save approximately $1.4 million, which will instead be used to fund other renewable energy and conservation projects in County schools.

Private, homeowner systems and cooperatively-owned systems are quickly catching on and being installed in St. Mary’s County.

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6St Mary’s County Comprehensive Plan, 2010, section 6-6
Figure 9-5. Areas of restorable oyster bottom in the St. Mary’s River oyster sanctuary. Courtesy of Maryland DNR.
Conservation Programs continued

Oyster Restoration and Preservation

Oyster Floats

Oyster floats permit homeowners to grow oysters in buoyant cages either under or adjacent to their docks. Oysters grown in floats may be designated for personal consumption, and serve as a means to improve water quality, while reducing usage of wild oyster stocks.

Aquaculture oyster floats can be claimed for a maximum allowed income tax credit of $500 per taxpayer.\(^8\) To receive this credit, homeowners are required to complete Part D of Form 502CR and attach it to a Maryland income tax return. Additionally the credit must also be reported on Maryland Form 502, 505, or 515.

Oyster Restoration

A Native Oyster Restoration Master Plan was completed in September 2012 by the U.S. Army Corps of Engineers and included an assessment of the current status of oyster populations in the Chesapeake Bay. Recommendations for large-scale restoration efforts would restore native oyster habitat and populations in 20 tributaries/areas in Maryland and Virginia by 2025.\(^9\) In Maryland, 14 tributaries/areas are cited for restoration, including the St. Mary’s River. The master plan also proposes that 20 to 40% of historic habitat be restored and protected as oyster sanctuary. Areas of restorable bottom in the St. Mary’s River oyster sanctuary were identified by MD DNR (see Figure 8-5).

In 2010, the St. Mary’s River became an oyster sanctuary encompassing 1,302 of the total 9,024 acres in the river. Historic oyster habitat in the St. Mary’s River, where watermen have harvested oysters, accounts for 2,461 acres, while only 1,058 acres are now identified as oyster habitat. However, local watermen estimate that oyster habitat is limited to well under 200 acres. The Master Plan recommended 214-423 acres as the restoration target area for the river. Surveys identified that 341 acres are currently suitable for oyster restoration under all conditions, 1,092 acres are suitable in some conditions, and 610 acres are not suitable under any conditions. Oysters are already doing well in the St. Mary’s River, partially due to its designation as a sanctuary. Provided thorough surveying, the St. Mary’s River may indicate that the 200 acre minimum


Conservation Programs continued

has already been reached. The Maryland Department of Natural Resources has stated that the St. Mary’s River is a fully restored river as of 2014, claiming that at least 214 acres are currently productive.

In 2013, oyster restoration under the Corps plan began in Harris Creek, and 343 acres were completed by 2015. Restoration in the Choptank began in 2015 and is anticipated to be completed by 2017. At this time, there is no schedule for restoration in the St. Mary’s River and it is likely that no public restoration projects will occur through 2025.

Marylanders Grow Oysters

The MGO program is another oyster restoration initiative and is managed by Maryland Department of Natural Resources, Oyster Recovery Partnership, Maryland Center for Environmental Science, and other local organizations. Beginning in 2008, this program has been growing oysters for restoration purposes by involving local homeowners in the process.10 Homeowners that participate in the MGO program receive oyster cages of vulnerable, juvenile spat-on-shell and steward them for up to a year. This program is currently active in 34 rivers, creeks, and covers of the Chesapeake Bay.

The St. Mary’s River and its tributaries (St. Inigoes Creek, St. George Creek, and Carthagena Creek) began participating in the MGO program in 2009 with 88 piers, hosting 600 cages. The program continues to be successful in the St. Mary’s River, with 105 docks and 637 cages as of the 2015-2016 winter season.

Oyster restoration in the St. Mary’s River has been primarily accomplished by a local non-profit organization, the St. Mary’s River Watershed Association. As of winter 2015-16, the Association, working with volunteers, funding partners, public schools, and youth groups, has planted over 31 million oysters on five restoration sites all within the sanctuary area. (Table 8.3).

St. Mary’s River Reef Project

The St. Mary’s Oyster Reef Project began in February 2012 and will be completed by February 2017. It is a partnership project between the St. Mary’s River Watershed Association, the Leonardtown Rotary Club, and St. Mary’s College of Maryland to construct habitat and conduct long-term monitoring of a 5 acre plot in Horseshoe Bend adjacent to the college.

The project was designed by college professors Chris Tanner and Bob Paul along with several students. Three-dimensional structures or mounds, each constructed with 10 to 40

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stacked reef balls or with 12 to 45 tons of stacked concrete rubble, are installed on a little more than half the area. Reef ball and concrete rubble mounds were either treated with veners of spat-on-shell or left barren for natural recruitment of wild oyster larvae. Four additional mounds, including two oyster shell piles and two reef ball mounds were constructed through the Maryland Industrial Partnership (MIPs) grant program, which pairs Maryland businesses with University of Maryland schools. Through the MIPs project these four mounds were seeded using an experimental in-situ method, in which oyster larvae are introduced to a closed system on the restoration site. The objective of this in situ method is to eliminate the labor required to transport substrate and spat to the restoration site. The effectiveness of this method is still being assessed.

Traditional methods of restoration involve hardening the bottom with 2 to 6 inches of oyster shell and then seeding with spat-on-shell. These flat shell bars, referred to as two-dimensional bars are installed on less than half (about 2.2 acres) of the plot and is intended as a control or comparison area to the three dimensional reef area. Flat shell bars, due to their structure and location at the bottom of the water column, tend to have high oyster mortality as they are highly susceptible to siltation, hypoxic events, and disease.

Oyster mortality associated with these factors may be reduced through the construction of three-dimensional mounds, a relatively expensive technique that mimics historic oyster reefs. The three-dimensional structure positions oysters higher in the water column and facilitates increased water velocity over the mounds, thereby reducing siltation and exposure to hypoxia and increasing food availability.\textsuperscript{11} it is anticipated that by reducing these stress factors, that disease will also be reduced.

Additionally, as oyster shell is becoming more difficult to obtain and costly to purchase for restoration purposes, use of alternative substrate in the construction of mounds may become a more cost-effective restoration strategy. Most importantly, the restoration techniques used in the Project could be easily replicated elsewhere in the Chesapeake Bay.

Since the Project’s start in 2012, over 600 reef balls and nearly 200 tons of concrete rubble have been installed into 36 three-dimensional reef structures (mounds), including 21 mounds comprised of stacked reef balls, 2 shell pile mounds each made from 135 bushels of oyster shell, and 13 concrete rubble mounds.\textsuperscript{12} More than 1,000 volunteers, of ages ranging from 8 to 78, have assisted in the manufacture of reef balls, installing reef mounds, and applying treatments. Project leaders anticipate the installation of three to five more mounds in 2016. The baseline evaluation and ongoing monitoring of the St. Mary’s Reef Project is overseen by the designers Tanner and Paul, and is being accomplished by Association and college interns. Additional research is ongoing using the reef as a living classroom or educational tool by local Great Mills High School STEM Academy and St. Mary’s College of Maryland students. Increasingly, the reef serves senior thesis research projects and for semester class projects in Ecology of Coastal Systems (2013-2016) and other courses. Additional information about the details of design and the long-term monitoring is available online: St. Mary’s River Oyster Restoration: Construction and Monitoring Final Report, prepared by St. Mary’s College of Maryland. (http://smrwa.org/pdf/docs/)

\textsuperscript{11} Paul, P. and C. Tanner. 2012. St. Mary’s River Oyster Reef Restoration: Construction and Monitoring Final Report. St. Mary’s College of Maryland, St. Mary’s City, MD, USA.
\textsuperscript{12} St. Mary’s River Watershed Association oversees the project management and implementation.
### Table 9-4. Reef mound type and veneer treatments in the three-dimensional reef plot.

<table>
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<tr>
<th>Reef Number</th>
<th>Reef Type</th>
<th>Veneer Treatment</th>
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<tr>
<td>1</td>
<td>Rubble</td>
<td>Spat-on-shell</td>
</tr>
<tr>
<td>2</td>
<td>Reef ball</td>
<td>Spat-on-shell</td>
</tr>
<tr>
<td>3</td>
<td>Rubble</td>
<td>Spat-on-shell</td>
</tr>
<tr>
<td>4</td>
<td>Rubble</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Reef ball</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Reef ball</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Shell pile</td>
<td>In-situ larvae</td>
</tr>
<tr>
<td>8</td>
<td>Rubble</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Reef ball</td>
<td></td>
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<tr>
<td>11</td>
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<tr>
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<td>23</td>
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<td></td>
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<tr>
<td>24</td>
<td>Reef ball</td>
<td>In-situ larvae</td>
</tr>
<tr>
<td>25</td>
<td>Rubble</td>
<td>Spat-on-shell</td>
</tr>
<tr>
<td>26</td>
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<tr>
<td>27</td>
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<td>29</td>
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<td>30</td>
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<td></td>
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<tr>
<td>34</td>
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<tr>
<td>35</td>
<td>Shell pile</td>
<td>In-situ larvae</td>
</tr>
<tr>
<td>36</td>
<td>Rubble</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 9-6.** Reef mound types and location installed through the St. Mary’s Reef Project in 2012 to 2016. If no reef type is indicated, the reef is pending construction in 2016. If no treatment is indicated, then no treatment was installed. Reefs 37 and 38 are made of two rows of reef balls with some elements set with spat in the nursery.
Smart Growth

Smart Growth planning is a sustainable means to protect natural resources by avoiding urban sprawl. This is to be accomplished by revitalizing preexisting infrastructure or incorporating new development into already developed areas. The following Smart Growth laws and policies were administered by the Maryland Department of Planning:

- 1997 Priority Funding Areas Act
- 2006 Planning Legislation
- 2009 Smart, Green and Growing Legislation
- 2010 Sustainable Communities Legislation
- 2012 Sustainable Growth & Agricultural Preservation Act

The Lexington Park Development District Master Plan Staff Draft 2013, in accordance with the Plan Maryland 2011 executive policy plan, identified strategies for preservation, growth, and revitalization in St. Mary’s County. Growth goals for the county are also outlined in the St. Mary’s County Planning Commission Annual Report, which allocates 70% of residential and non-residential growth to development districts, town centers, and village centers. No more than 30% of this growth would be allowed in the rural preservation district. Additionally, new development in the 2014 fiscal year was limited to a 1.9% annual increase of housing units. The following topics provide a means to preserve rural areas, concentrate new development, and retain functional open space.

Priority Funding Areas

PFAs are existing communities where future growth is encouraged. Maryland Smart Growth legislation requires that residential developments have a density greater than 3.5 units per acre in PFA’s. Development, redevelopment, and investment in the central subarea are of high priority.

Transfer of Development Rights

The TDR program allows for landowners to transfer the right to build a house from a location where development is prohibited, or not ideal, to one that is encouraged. In the case of St. Mary’s County, TDRs are used to encourage growth in the Lexington Park Development District. In the 2013 Master Plan, St. Mary’s County suggests that the TDR program consider allowing green infrastructure to qualify as sending certain areas whose development rights can be transferred, to other areas of growth.

Forest Stands and Open Space

As part of green infrastructure conservation, the 2013 Lexington Park Master Plan Staff Draft states that existing forest stands and isolated areas of green space, including parks, should be connected. Their connection would serve as protection against habitat fragmentation and degradation. The 2010 St. Mary’s County Comprehensive Plan also requires that at least 50% of existing forests (outside of the critical area) be preserved in the rural preservation district and greater than 20% in low-density residential zoning districts. Clearing of trees is also limited such that the preservation of critical areas results in a zero net-loss in forests.

The Open Space Framework is defined in the

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2013 Lexington Park Master Plan Staff draft connect parks, including the Jarboesville Park, John G. Lancaster Park, Freedom Park, and Nicolet Park, through sidewalks and hiking/biking trails (See Figure 8-6). Public spaces that are located in the downtown area are recommended for use as public greens or pocket parks that will also be connected through sidewalks or trails. These include areas at the Willows Road traffic circle, in St. Mary’s Square, and the new commercial center by Nicolet Park. Additionally, the 2013 Master Plan suggests that community gardens be incorporated into public land in employment centers.

Figure 9-7. Open Space framework proposed in the Lexington Park Development District Master Plan Staff Draft 2013.
Green Building and Site Design

Adding Green Infrastructure to Developments

Green building practices provide another level of environmental protection in the watershed. Over the last decade, primarily through the implementation of the Leadership in Energy and Environmental Design (LEED) by the U.S. Green Building Council, building practices throughout the county have been transformed. Greater recognition has been gained on the relationship of the built environment to human and ecological health. LEED provides a matrix for ways in which developers and owners can maximize economic and environmental performance in the construction, renovation, and operation of buildings.

Both St. Mary’s College of Maryland and St. Mary’s County Public Schools have been early advocates of the use of LEED in documenting green building practices in their capital improvements programs. Goodpaster Hall at St. Mary’s College, completed in 2008, was a pilot program for the State of Maryland in the construction of green buildings. Evergreen Elementary School was among the first forty school facilities in the nation to be registered under LEED.15 Both of these facilities are within the St. Mary’s River watershed and serve as important beacons for environmentally and fiscally responsible developments. Other organizations such as Habitat for Humanity have made a concerted effort to integrate green building practices into the construction of affordable housing.

LEED uniformly recognizes the following sustainable building practices:

- Appropriate site selection and use of land;
- Protect and restore habitat;
- Promote open space;

- Utilize best practices in minimizing stormwater runoff and channelization of streams;
- Reduce the heat gradient and light pollution that results from typical developments;
- Reduce water consumption and demand on wastewater treatment facilities;
- Reduce energy consumption and the emission of greenhouse gases and ozone depleting chemicals;
- Efficient use of environmentally preferable materials and minimize waste during construction;
- Reduce the impact from transportation by using local materials;
- Improve indoor environmental quality by using low-emitting materials;
- Educate others on how to build and operate facilities in a more environmentally responsible manner.

The U.S. Green Building Council has expanded LEED to include LEED for Homes and LEED for Neighborhoods. These programs are especially applicable to the protection of the St. Mary’s River watershed, since residential

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Green Building and Site Design, continued

construction is far more land intensive and creates far more impervious surfaces annually than commercial or institutional developments. Protection of water quality is a fundamental goal under all LEED programs. LEED encourages performance in excess of regulatory standards, including those for storm water management. LEED also stresses water conservation and innovative wastewater technologies.

Many jurisdictions throughout the country have provided incentives for residential construction that achieves LEED’s standards. Arlington County, Virginia was one of the nation’s first to allow for high density developments if projects earned a LEED Silver certification. Baltimore County provides tax credits for new residential construction that earns a minimum of LEED Silver certification. St. Mary’s County should be encouraged to consider similar programs. At a time when the County is facing financial challenges in providing adequate public facilities, providing incentives for lower impact developments makes good economic sense.

The St. Mary’s River watershed is fortunate to have within its boundaries exceptional educational institutions. St. Mary’s College of Maryland has a legacy of environmental and community stewardship. The college was one of the first in the nation to purchase 100% of its energy from green sources. The college connected to public sanitation in the 1980’s which significantly improved the water quality of the St. Mary’s River. The college also adopted policies to construct all new facilities under LEED and to exceed mandatory requirements on storm water management.

St. Mary’s County Public Schools also has a strong history of environmental design and stewardship. With more than a decade of energy performance contracts and emphasis on conservation, St. Mary’s County Public Schools’ energy consumption per square foot is among the lowest in the state. The school system incorporated green features such as energy recovery and daylighting into its modernization efforts throughout the 1990’s. Evergreen Elementary School, its first new school in over twenty-five years, is the school system’s first LEED certified facility. Evergreen Elementary is also a prototype for two additional elementary schools that are anticipated in the next ten years. Equity in education and facilities is a core value of St. Mary’s County Public Schools. St. Mary’s County Public Schools has established a “Green Schools” program to take the lessons and experiences derived from Evergreen Elementary School to other schools throughout the system. A mobile green classroom will be
Green Building and Site Design, continued

transported around the County with
demonstrations and lessons on solar energy,
energy conservation, and local environmental
challenges. Green Schools Coordinators have been
established at all schools to promote sustainable
practices in the operation of school facilities.

A robust partnership between educational
institutions within the watershed should be
encouraged and cultivated. St. Mary’s College of
Maryland, St. Mary’s County Public Schools, and
the College of Southern Maryland should all look
for opportunities to use their combined talents and
resources for environmental education. One of the
most promising is the relationship between the
Educational Studies Program at St. Mary’s College
and St. Mary’s County Public Schools. Students
interested in teaching careers are placed into local
schools as student teachers. Graduates from the
Educational Studies Program are a significant
source of permanent teachers for the school system
as well. The Educational Studies Program can be
an important resource in the development of
environmentally related lesson and unit plans,
promoting environmental education and
stewardship in St. Mary’s County Public Schools.
Knowledge and strategies for the protection of the
watershed can be imparted to the local school
system through the work of student teachers and
graduates of the Educational Studies Program.

Green Site Design

Grey Water Reuse

Grey water reuse was identified in the 2010 St
Mary’s County Comprehensive Plan, as a method
to significantly reduce the use of aquifer water for
uses other than drinking water. Potable water uses
in the county include watering lawns and athletic
fields, landscaping and industrial uses. Grey water,
or effluent water, was suggested to be suitable for
these water uses, especially as waste water
treatment techniques have advanced enough to
support both potable and non-potable needs. Grey
water reuse alleviates pressure from aquifers, and
may be ideal in preserving existing water
resources.

According to the 2010 Comprehensive Plan,
the St. Mary’s County Commission on the
Environment was instructed to investigate various
water conservation methods and assess which has
a high potential payback both with and without
incentives. The County also requested that the
State Water Resources Management Advisory
Committee address water conservation and reuse
options to amend State and local regulations to
legalize and encourage these types of methods.
The county is also currently identifying areas
where water reuse may be feasible.

Current regulations and guidelines in
Maryland for water reuse have been published in
the Maryland Register, effective May 2010.16
These include that reclaimed water can be used
for irrigation of farmland, golf courses, athletic
fields, turf landscaping, and any other uses the
Department deems appropriate. Guidelines for
discharge to groundwater was amended to include
reuse of treated Class III effluent, in non-
restricted public access areas for irrigation given
a buffer zone between potable wells and water
intake.

Septic System Upgrades and Grant Program

Traditional septic systems are not capable of
removing nitrogen, and therefore systems that are
in close proximity to the water, especially within
the Critical Area (1000 feet of tidal waters), pose
a significant threat to aquatic systems. However,
current Best Available Technologies (BAT)
include upgraded septic systems capable of
removing approximately half of their nitrogen
load.17 These septic upgrades serve as an
important tool to reduce nutrient inputs to local
waterways, thus contributing to protection of the
Chesapeake Bay. Maryland’s Department of the

17 Maryland’s Nitrogen–Reducing Septic Upgrade Program. MDE. http://www.mde.state.md.us/programs/Water/
BayRestorationFund/OnsiteDisposalSystems/Pages/Water/cbwrf/index.aspx
Environment has been upgrading septic systems using the Bay Restoration Fund (BRF) Onsite Sewer Disposal System (OSDS) grant program. The St. Mary’s County Health Department’s Clean Water Program locally administers the BRF and prioritizes upgrades by the following criteria.\(^\text{18}\)

1. Failing septic systems within Critical Areas
2. Failing septic systems outside Critical Areas
3. Non-conforming septic systems in Critical Area
4. Non-conforming septic systems outside Critical Area
5. Non-failing septic systems in 1000 foot Critical Areas Buffer
6. Non-failing septic systems outside of the 1000 foot Critical Area Buffer

To apply for a BRF grant to upgrade your septic system, follow the steps listed on the St. Mary’s County Health department website (http://www.smchd.org/bay-restoration-grant/).

As of January 2013, all new construction—including outside of the Critical Area—requires nitrogen-reducing septic systems. However, sites outside of the Critical area are not required to replace failing septic systems with nitrogen reducing units.

**Green Schools—Energy Conservation**

The Green School Program certification is awarded through the Maryland Association of Environmental and Outdoor Education.\(^\text{19}\) Schools in this program must promote energy conservation, environmental awareness through education, employment of environmental best management practices, and community stewardship. Schools must be recertified every four years, and are granted the title of Sustained Green School after three successful recertifications.

**Green schools in the St. Mary’s River Watershed:**

- Chesapeake Public Charter School (2009)
- Greenview Knolls Elementary (2010)
- Evergreen Elementary (2011)
- George Washington Carver Elementary (2011)
- Green Holly Elementary (2012)
- Park Hall Elementary (2013)

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Maryland’s Fish Passage Program

The Chesapeake Bay Agreement, signed in 1987 by all states within the Bay Watershed, included commitments from each state to "provide for fish passage at dams, and remove stream blockages wherever necessary to restore passage for migratory fish." A goal for Maryland was set to reopen 388.65 miles of stream. So far, the state has completed 61 projects, accounting for 348.9 miles of upstream habitat. The state plans to meet and exceed the goal through efforts by the Maryland Department of Natural Resources, State Highway Administration, National Marine Fisheries Service, National Oceanic & Atmospheric Administration, Department of Interior, US Fish & Wildlife, Environmental Protection Agency, Chesapeake Bay Program, Chesapeake Bay Foundation, University Maryland, and others including private citizens, local watershed groups and local governments.

Migratory fish contribute to a flow of nutrients between freshwater and marine systems and are valuable species in the marine and coastal food webs. Catadromous fish, such as American eels, spawn in the ocean and their offspring migrate through estuaries and into freshwater streams to mature. Anadromous fish, including American shad and Alewife, do the opposite: adults spawn in freshwater and their offspring migrate into marine and coastal waters to develop. Both types of migratory fish require safe passage between marine, estuarine, and freshwater areas in order to complete their reproductive life cycle and sustain the next generation’s population. Therefore, the removal of stream obstructions is critical to enable safe passage of adults or juveniles and ensure the continuation of the species.

Fish blockages in St. Mary’s River Watershed:

- Gauging wire in St. Mary’s River Stream, (Great Mills at intersection of Indian Bridge Road and Western Branch Road)
- Small dam at St. Mary’s College of Maryland, Mattapany Road. (See photo above)
- Dam near Andover Estates Rd., Locust Grove Cove, Tributary St. George Creek

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20 Fish Passage. MD Department of Natural Resources. Website: http://dnr2.maryland.gov/fisheries/Pages/fishpassage/index.aspx. Accessed December 2014.
Forest and Wetland Restoration

Mitigation sites were proposed in the KCI study (1998) to protect water quality and wildlife and determine areas unsuitable for development. Sites were evaluated for their environmental features, including forests, wetlands, streams, and the biological resources associated with such habitats. Additionally, sites which contained habitat of sensitive species or overlapped with each other were assessed to preserve contiguous areas with a variety of available resources. Proposed sites were selected for their prospective success.

*Forest Mitigation sites*

These sites were selected for being a transitional zone between farm land and forests or was adjacent to protected lands. Proposed sites also satisfied one or more of the following conditions:

- Area is adjacent to parkland, FIDS habitat, or contiguous wetlands/forests
- Area adds or creates riparian buffers
- Area potentially improves water quality or habitat conditions
- Area is accessible and feasible

*Wetland Mitigation Sites*

These sites were selected for the presence of hydric soils or for being adjacent to wetlands or hydric soils. Proposed sites have one or more of the following conditions:

- Area is adjacent to parklands, known breeding area for FID bird species, contiguous wetlands/forests
- Area has potential for wetland hydrology
- Area adds or creates riparian buffers
- Area potentially improves water quality or habitat conditions
- Area is accessible and feasible
- Area would require minimum re-grading or was a disturbed site

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PROJECTS RELATED TO THE WRAS PROCESS

Watershed Implementation Plans

After pollution reduction goals were not met in 2010, the Environmental Protection Agency requested the development of Watershed Implementation Plans (WIPs) by the Chesapeake Bay states to hold each jurisdiction accountable for their pollution loads. The Maryland WIPs are to be developed in three phases, with Phase I in 2010, the Phase II in 2011, and Phase III in 2017.

Phase I of Maryland’s WIP included the development of final target loads to allocate the allowable loads of phosphorus, nitrogen, and sediment by each pollution source sector and region in Maryland. By meeting these target loads, the pollutant levels entering the Chesapeake Bay can be reduced. Maryland’s WIP Phase I has been completed and indicated Maryland’s commitment to complete final target loads by 2020, with an interim goal of 70% completion by 2017.

The Phase II Plan was developed in 2011 to refine the Phase I plan by further specifying the geographic areas for target loads by coordinating efforts at the Federal, State, and County level. The Phase II plan identifies the pollution controls that are to be implemented by states and partners by the end of 2017. The 2011 final target loads for Maryland were revised to the scale of 5 major basins. The Potomac River Basin, which includes the St. Mary’s River watershed, had nitrogen, phosphorus, and sediment target loads of 15.29, 0.94, and 731 million pounds per year, respectively. These target loads were further divided by pollution source sectors: agriculture, forest, non-tidal atmospheric, septic, storm water, and wastewater.

Phase III is to be developed by 2017. It will address reductions needed, evaluate the remaining 30% of target loads in Maryland from 2018 to 2020, and provide another opportunity to revise TMDL allocations.

Native & Non-native Oyster Restoration PEIS

The Programmatic Environmental Impact Statement (PEIS) for Oyster Restoration in Chesapeake Bay, including the use of a native and/or nonnative oyster was finalized in April 2009. This EIS was completed by the US Army Corps of Engineers, MD Department of Natural Resources, and the Virginia Marine Resources Commission.

The Oyster Restoration PEIS addresses various alternatives to restore oyster populations in the Chesapeake Bay. Two of the proposed alternatives include introducing the non-native

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Suminoe Oyster (Crassostrea ariakensis, native to China). Methods may include the cultivation of reproductively sterile individuals, or the use of reproducing Suminoe oysters for restoration. Following public input and extensive review by federal, state, and local agencies, the executive committee determined that the ecological risks associated with introducing a non-native oyster were determined too high to offset restoration benefits and that approach 8a was the ideal strategy. Approach 8a calls for a strategic combination of enhanced native oyster restoration, harvest moratorium, and aquaculture in order to advance restoration goals. The final decision can be found at http://www.nao.usace.army.mil/Portals/31/docs/civilworks/oysters/oysterdecision.pdf. The Final PEIS Report can be accessed at http://www.dnr.state.md.us/irc/docs/00015764.pdf.

Watershed Evaluation for St. Mary’s River Watershed
The St. Mary’s River Watershed Assessment Plan was prepared for the St. Mary’s County Department of Planning and Zoning by KCI Technologies, Inc. in 1998. This evaluation identified areas in the watershed that were either unsuitable for development, had development limitations, or could serve as forest and wetland mitigation sites. These recommendations would serve as supplementary information for the St. Mary’s County Government’s Comprehensive Master Plan to the protection, restoration, and preservation of the County’s natural resources.

Pinney Point Aquaculture Facility
1. Potomac River Eelgrass Restoration

The Strategy to Accelerate the Protection and Restoration of Submerged Aquatic Vegetation in the Chesapeake Bay, developed by the Chesapeake Bay program and its partners, identified the need for large-scale SAV restoration efforts. Traditional methods for restoring eelgrass beds require labor-intensive manual planting of adult eelgrass, transplanting whole plants from healthy preexisting beds into restoration sites. Recent studies have suggested that seed dispersal may be a more efficient and cost effective method for large-scale restoration efforts. Additionally, this method would not require the removal of adult plants and therefore may reduce impacts on healthy SAV beds.

Large-scale restoration sites with environmental conditions ideal for eelgrass growth were determined using an SAV Restoration Targeting System. These conditions included suitable light attenuation (light availability), seston (plankton and fish), chlorophyll a, nutrients, salinity, and water depth. In regions that satisfied those criteria, areas that maintained 0.1-1 meter mean low water and supported historic eelgrass populations were identified for restoration.

Sites were located in the lower mesohaline regions of the Potomac River and Patuxent River. Within this region, 5 sites were

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identified for restoration: Cherryfield Point, Piney Point, St. Georges Island, Sage Point, and Kitt’s Point. The former 3 areas are part of the St. Mary’s River Watershed, while the latter are in the division between the watershed and the lower Potomac River. Seeds were collected from Chincoteague and Tangier Sound and stored in the Piney Point Aquaculture Facility before dispersal in either fall or spring. Fall dispersals were performed in 2006, 2007 and 2008, and 2013 with a mechanical seed sprayer, which controlled the average density of seeds planted per acre. Adult eelgrass plants were also transplanted to be compared to seedlings for growth and survival.

Plots were monitored for the growth of eelgrass seedlings. By the following spring there was high seedling establishment at St. George Island, relative to the other restoration sites (1.4% establishment of total seeds planted).

No seedlings were observed at Piney point. Long-term survival of seedlings was only observed at St. George Island and Cherryfield Point, with a 559% and 89% increase in eelgrass density, respectively. This affirms that site selection is vital to the restoration of SAV, as areas where eelgrass were previously observed (St. George) fared well, while other sites in which eelgrass was never observed (Piney point) had no long-term success.

Cherryfield Point, Sage Point, and Kitt’s Point had intermediate success.

In 2005, bay-wide die-offs of eelgrass were observed, with similar declines experienced in restoration sites as only adult transplants in St. George Island survived the hypoxic and high-temperature summer conditions. These conditions were also found to affect seedling and adult transplant survival in 2006. Eelgrass transplanted in 2005 and 2006 had 10% survival rates after 19 months and 33% survival after 20 months at Cherryfield Point. St. George Island transplants in 2006 experienced 16% survival at 19 months and by 20 months all planted areas had expanded to cover the entire planting area.

2. **Piney Point Blue Crab Nursery**

The Department of Natural Resources Piney Point Aquaculture Facility managed a blue crab nursery in 2004, as part of a hatchery research project to supplement the Chesapeake Bay blue crab population. As the recruitment of juvenile blue crabs has been at historic low level, hatchery operation may be a cost effective means to bolster the declining spawning population.

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This project, which was federally funded by a consortium of universities and institutions, required that blue crabs successfully undergo their larval development and survive to maturity. Blue crab hatcheries had been unsuccessful until this project due to the blue crabs’ lifestyle; blue crabs have 8 larval stages, each of which requires a different diet. Additionally, once crabs reach their megalopae larval stage and develop claws, they become cannibalistic, reducing survival rates in nursery settings. Nevertheless, researchers at the University of Maryland’s Center of Marine Biotechnology have successfully identified suitable prey species and techniques for increasing survival.

At two months of age, juveniles from various cohorts of blue crabs grown at Piney Point were tagged and released in the upper and lower Chesapeake Bay between 2002 and 2006. The results from monitoring release sites are promising, with 15-30% of hatchery crabs surviving to maturity, effectively doubling or tripling local wild populations. Genetic analysis also indicates that hatchery crabs are not genetically different from wild crabs. Therefore, hatchery crabs can reproduce with wild crabs, enhancing recruitment in the wild.

Blue crab hatcheries are a promising tool for improving crab populations in the Bay, and this report suggests that hatchery methods can be effectively scaled up, with facilities being operated by local watermen.

St. Mary’s River Watershed Association Oyster Recovery Assessment Study

This project aimed to increase biomass and commercial harvests of oysters and improve water quality in the St. Mary’s River by farming selectively bred native oysters in floats. Floats were assessed for their impact on water quality and biodiversity, compared to the ecological effects of traditional reef structures. Three separate studies were performed: a field study at the Chesapeake Biological Laboratory, a laboratory study at St. Mary’s College of Maryland, and a field study of float biodiversity in the St. Mary’s River.

The CBL field study used mesocosms, or tanks with a closed system of circulating water from St. George Creek to identify the effect of oysters on water quality. These tanks contained either floats with oysters from Circle C Oyster Ranch or control floats containing dead shell. Water quality was monitored hourly for temperature, salinity, dissolved oxygen, and suspended solids. Following the experimental period, oyster survival and the colonization of encrusting organisms on the shells were assessed. The filtering capability of the organisms that colonized the dead oyster shells was considerable relative to the live oysters. Although the live oyster removed suspended solids at a far greater rate, it is important to also note that the colonizing organisms make a sizable contribution to enhancing water quality.

The small-scale laboratory study at SMCM compared the filtering capability of native

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6 Ibid (crab hatchery, previous page)
Oysters from the St. Mary’s River to selectively-bred oysters from the Circle C Oyster Ranch. Oysters were submerged in tanks containing water from the St. Mary’s River. The study found that selectively-bred oysters were able to filter algae and sediments from water at significantly greater rates than the native St. Mary’s River oysters.

The St. Mary’s River field study monitored the colonization of organisms in oyster floats by deploying floats from homeowner docks throughout the river. However, significant oyster mortality and vandalism of test floats occurred in the winter of 2007, reducing the number of oysters and floats remaining for analysis. Colonization was assessed for the remaining floats, and bags with living oysters and non-living oyster shell hosted similar communities of fish and invertebrates, and did not differ in species abundances or diversity. These communities closely reflected those observed in natural oyster reefs of the St. Mary’s River, suggesting that floats serve as sufficient habitat for other organisms in the river.

Potomac Riverkeeper: River Watchers

The Potomac River Watchers Network is a group of volunteers, trained by the Potomac Riverkeepers, who report on pollution incidents that occur in the Potomac River Watershed. These volunteers provide first-hand accounts and provide evidence, by water samples or photograph, of the incidence. Pollution on the river can be reported by email at keeper@potomacriverkeeper.org or by calling 202-222-0707. This network serves as an extensive monitoring effort in the watershed, catching pollution when it happens and mitigating the impacts of these violations. For more information about becoming a volunteer visit at http://www.shenandoahriverkeeper.org/riverwatcher.

Potomac Cleanup and Trash-Free Initiative

The St. Mary’s River Watershed Association has partnered for seven years in cleanups and trash reduction efforts with the Alice Ferguson Foundation including the watershed-wide annual Potomac River Watershed Cleanup. In 2015, the 27th annual cleanup enlisted more than 23,898 volunteers in removing 601 tons of trash from 805 sites in the basin. Within the St. Mary’s River watershed, more than 1100 pounds of trash is removed each year. An offshoot of the cleanup is the Potomac Watershed Trash Free Initiative, which seeks to end litter in the watershed.

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Lexington Park Redevelopment Campaign

As Three Notch Road and Great Mills Road are heavy traffic areas, especially during peak hours, road projects have been proposed for the Lexington Park Development District to become a connected, walkable community. This includes the completion of FDR Boulevard, using a Complete Streets concept, in which bike lanes, sidewalks, and landscape medians are incorporated into road construction and revitalization.

Transportation

The 2013 Lexington Park Development District Master Plan Staff Draft defines street connection projects in three priority classes, with the first priority to begin immediately, the second to be initiated by 2020 and third priority be initiated by 2020-2030, unless developers are driven sooner.10 Extensions to the following streets will serve to improve the connectivity within the Lexington Park Core and to Downtown.

Proposed Street Connections:

1. FDR Boulevard

   The development of FDR Boulevard will be completed in a 5 phase project, including the completion of missing segments in the corridor and constructing connector roads from FDR Blvd. to 235.

2. Pegg Road Extension

   This proposed expansion would connect Pegg road from Chancellor’s Run Road to the intersection of Point Lookout Rd. and Piney Point Road.

3. Shangri La Drive

   A traffic circle would connect Willows Road at its intersection with North Shangri La Drive to Point Lookout Road via Lei Drive.

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POTENTIAL BENCHMARKS FOR WRAS GOAL SETTING

The St. Mary’s River WRAS will aim to address the issues and challenges set forth in the previous sections, with the ultimate aim of improving water quality, enhancing biological resources and habitats, and protecting and improving the social and economic welfare of the watershed’s residents.

In order to promote these goals, the St. Mary’s River WRAS will describe benchmarks and indicators which can help evaluate the effectiveness of the WRAS’s implementation in the watershed. These benchmarks should also be consistent with previous watershed plans at the federal, state and county levels and should contribute to the goals laid out in these plans. Plans, strategies, and policies which can provide guidance for the St. Mary’s River Watershed include the Breton Bay WRAS (Table 10-1), the Coastal Zone Management Program, the Chesapeake Bay 2014 Watershed Agreement, the Federal Clean Water Action Plan, the 1998 Water Quality Improvement Act, and the Hilton Run Management Plan.

Breton Bay WRAS

The Breton Bay WRAS establishes programs and activities for the achievement of the 5 elements delineated in Table 10-1, as well as short term and long term goals for these programs and activities. These goals could provide examples of what to address in drafting the St. Mary’s River WRAS.

<table>
<thead>
<tr>
<th>WRAS Element</th>
<th>Activity/Program</th>
<th>Short-term Goal (1-2 yrs)</th>
<th>Long-term Goal (2-5 yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 - Reduce current sediment and nutrient inputs to Breton Bay by addressing point and non-point pollution sources</td>
<td>1.1 Leonardtown Wastewater Treatment Plant Biological Nutrient Removal (BNR) Upgrade</td>
<td>Complete the Upgrade, add signage and viewing area</td>
<td>Improve public perception and awareness of plants role in protecting Breton Bay, Achieve a certification level or award</td>
</tr>
<tr>
<td></td>
<td>1.2 Leonardtown Stormwater Management Retrofits</td>
<td>Complete SW retrofit of Government Center, Identify two additional stormwater management retrofit opportunities</td>
<td>Utilize the Government Center SWM Retrofit as a demonstration area, Implement additional SW retrofit projects</td>
</tr>
<tr>
<td></td>
<td>1.3 Stream Restoration/Stabilization</td>
<td>Stabilize slope failures along the unnamed tributary to McIntosh Run and initiate a geomorphic assessment of Town Run</td>
<td>Restore/Stabilize Town Run, Complete Geomorphic assessment of Town Run</td>
</tr>
<tr>
<td></td>
<td>1.4 Municipal pollution prevention/education</td>
<td>Conduct an audit of municipal pollution prevention practices</td>
<td>Revise/adopt municipal practices to minimize pollution</td>
</tr>
<tr>
<td></td>
<td>1.5 Commercial Education Outreach Program</td>
<td>Develop a commercial outreach/education program</td>
<td>Implement commercial outreach/education program</td>
</tr>
<tr>
<td>#2 - Encourage sound agricultural and forestry practices that maintain income and the rural landscape while protecting sensitive natural resources and unique plant and wildlife habitats</td>
<td>2.1 Agricultural Best Management Practices</td>
<td>Initiate a buffer enhancement program in conjunction with GEF</td>
<td>Complete five buffer enhancement projects</td>
</tr>
<tr>
<td></td>
<td>2.2 McIntosh Run Land Conservation Partnership (MRLCP) and Potomac Tidewater Trust</td>
<td>Inform property owners of the land conservation opportunities MRLCP and the Potomac Tidewater Trust</td>
<td>Enroll at least one property in a conservation program/easement</td>
</tr>
<tr>
<td></td>
<td>2.3 Natural Resource Management Guidance for Rural Homeowners</td>
<td>Create an informational brochure for new homeowners/builders</td>
<td>Incorporate brochure into public education program (see #5)</td>
</tr>
</tbody>
</table>

Table 11-1. WRAS elements and goals, both short term and long term, from the Breton Bay WRAS. Credit: Center for Watershed Protection, The Breton Bay Watershed Restoration Action Strategy

Coastal Zone Management Program

The CZMP is a voluntary partnership between the federal government and coastal states, for the aim of complying with section 309 of the 1972 Coastal Zone Management Act. There are three main components of the program:

- **Federal Consistency**: ensures that federal actions which impact coastal zones do not violate the enforceable policies set by the states whose coasts are affected.
- The **Coastal Zone Enhancement Program**: provides incentives to states to improve 9 key areas affecting coastal zones: wetlands, coastal hazards, public access, marine debris, cumulative and secondary impacts, special area management planning, ocean and Great Lakes resources, energy and government facility siting, and aquaculture.

- The **Coastal Non-Point Pollution Control Program**: ensures that participating states have adequate resources to address polluted runoff problems.

Of the three components, the enhancement program is the most important for guiding the St. Mary’s WRAS.

The Chesapeake 2014 Watershed Agreement Goals include:

- Achieving sustainable fisheries
- Restores, enhance, and protect vital habitats
- Achieve water quality necessary to sustain and protect the Bay’s aquatic living resources

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POTENTIAL BENCHMARKS FOR WRAS GOAL SETTING

<table>
<thead>
<tr>
<th>WRAS Element</th>
<th>Activity/Program</th>
<th>Short-term Goal (1-2 yrs)</th>
<th>Long-term Goal (2-5 yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#3 - Increase the understanding and awareness of watershed issues and promote active stewardship among commercial and residential stakeholders</td>
<td>3.1 &quot;Enforcing the Breton Bay Watershed&quot; signs</td>
<td>Install five &quot;Enforcing the Breton Bay Watershed&quot; signs along Rts. 234, 5 North, 5 South, 4, and Hollywood Rd.</td>
<td>Have community groups/businesses adopt signs and future maintenance.</td>
</tr>
<tr>
<td>3.2 Storm drain stenciling</td>
<td>Recruit a group/organization and initiate stormdrains stenciling</td>
<td>Stencil all stormdrains in Leonardtown and watershed</td>
<td></td>
</tr>
<tr>
<td>3.3 Residential pollution prevention/education campaign</td>
<td>Establish website, hire intern to develop program, and initiate program in Cherry Cove/Combs Creek Subwatershed</td>
<td>Expand program watershed-wide</td>
<td></td>
</tr>
<tr>
<td>3.4 Tree Planting (Grow-out Station)</td>
<td>Establish grow-out station, identify opportunities to plant in Moll Dyer’s Run</td>
<td>Plant trees as public participation project in Moll Dyer’s Run</td>
<td></td>
</tr>
<tr>
<td>3.5 SAV Planting</td>
<td>Recruit group/school to grow plants, support a PRA planting day the following season</td>
<td>Establish growing program at local school</td>
<td></td>
</tr>
<tr>
<td>3.6 Golf Courses</td>
<td>Approach Golf Courses about stewardship programs</td>
<td>Promote golf course achievements to encourage others</td>
<td></td>
</tr>
</tbody>
</table>

**Potential Funding Sources:**

- State and federal grants
- County and town funds
- Private donations
- Foundation grants

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Table 11-1, cont. WRAS elements and goals, both short term and long term, from the Breton Bay WRAS. These goals could provide examples of what to address in drafting the St. Mary’s River WRAS. **Credit: Center for Watershed Protection, Breton Bay WRAS**

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Achieve state-identified healthy watersheds
Increase public and private stewardship
Conserve lands for ecological, economic, community, and aesthetic value
Expand public access to the Bay and its tributaries
Enable environmental literacy in schools and in Bay area residents
Increase climate resiliency in the Bay watershed

**Clean Water Action Plan**
A Federal plan which set goals to utilize watershed approaches in order to:
- Improve safety of fish and shellfish
- Ensure safe beaches
- Expand storm water controls (not fully covered under original CWA)
- Improve state/tribal abilities to address and enforce pollution regulations and controls
- Define nutrient reduction goals (TMDLs)
- Reduce pollution from animal feeding operations (AFOs)

**Water Quality Improvement act of 1998**
Comprehensive legislation for nutrient management on farms and AFOs, which required most Maryland farms to develop nutrient management plans (NMPs) to control manure and nutrient leaching from farmland and pastures. However, given the strict nature of the regulations and the voluntary nature of the legislation, compliance was never very good among Maryland farmers.

**Management plan for Hilton Run**
Hilton Run is a sub-watershed of the St. Mary’s River, and management of Hilton Run affects the larger St. Mary’s River watershed, especially because the Hilton Run watershed encompasses the Lexington Park Development District.

Strategies for the evaluation of the Hilton Run plan include:
- Monitoring water quality data being accumulated by SMCM, including measurement of storm impacts
- Monitoring SAV losses or gains, plus impacts of new restoration activities
- Monitoring impervious surface coverage and effects of increases
- Recording changes in policy/practice per plan’s recommendations

**Clean Water Act, a-i criteria**
The EPA established 9 minimum criteria in 2003, which watershed restoration plans must meet to receive funding under Section319:
A. Identification of the causes and sources that will need to be controlled to achieve the load reductions estimated in the watershed plan
B. Estimates of pollutant load reductions expected through implementation of proposed nonpoint source (NPS) management measures
C. A description of the NPS management measures that will need to be implemented
D. An estimate of the amount of technical and financial assistance needed to implement the plan
E. An information/education component that will be used to enhance public understanding and encourage participation
F. A schedule for implementing the NPS management measures

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POTENTIAL BENCHMARKS FOR WRAS GOAL SETTING

G. A description of interim, measurable milestones

H. A set of criteria to determine load reductions and track substantial progress towards attaining water quality standards

I. A monitoring component to determine whether the watershed plan is being implemented

St. Mary’s River Watershed Plan

Produced by the Center for Watershed Protection in 2012, the watershed plan is a 9-element strategy. Each element addresses one of the CWA’s a-I criteria. Of particular importance to formulating the St. Mary’s River WRAS are elements G-I:

G: short-term and long-term goals are established for many recommended restoration measures in the watershed (Table 2).

Table 2 does not address needed or ongoing restoration efforts for oysters or SAV in the river, despite acknowledging its value in Element C (proposed management measures).

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Location</th>
<th>Responsible Parties</th>
<th>Time frame</th>
<th>Goal #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Nutrient Management</td>
<td>Regulate fertilizer applications on 3,000 acres of commercial/institutional property through Maryland’s Nutrient Management Law</td>
<td>County wide</td>
<td>Maryland Department of Agriculture (MDA), St. Mary's County, St. Mary's College of Maryland</td>
<td>Short term</td>
</tr>
<tr>
<td>Urban Nutrient Management</td>
<td>Work with environmental organizations/agencies to implement homeowner education programs to promote “BayWise”-type lawn management practices on 20,000 acres of private turf</td>
<td>County wide</td>
<td>Maryland Department of Agriculture (MDA), St. Mary's County, St. Mary's River Watershed Association (SMRWA)</td>
<td>Short term</td>
</tr>
<tr>
<td>Septic System Upgrades</td>
<td>Retrofit 60 septic systems in the Critical Area per year to BAT</td>
<td>County wide</td>
<td>St. Mary’s County Health Department, MDE</td>
<td>Long term</td>
</tr>
<tr>
<td>Septic System Maintenance</td>
<td>Conduct outreach to homeowners about maintaining septic systems</td>
<td>County wide</td>
<td>St. Mary’s County Health Department, MDE, SMRWA</td>
<td>Short term</td>
</tr>
<tr>
<td>Buffers</td>
<td>Increase shoreline buffers by 2,361 acres and outreach to residents on buffer management</td>
<td>Critical Area</td>
<td>SMRWA, MD DNR, St. Mary’s County, NRCS, SCD</td>
<td>Long term</td>
</tr>
</tbody>
</table>

Table 11-2. Goals, locations, responsible parties, and milestones set for restoration recommendations in the St. Mary’s River watershed. Table from the Center for Watershed Protection, St. Mary’s River Watershed Plan.8

7ibid (St. Mary’s River Watershed Plan)
8ibid
<table>
<thead>
<tr>
<th>recommendation</th>
<th>location</th>
<th>responsible parties</th>
<th>time frame</th>
<th>goal #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffers</td>
<td>County wide</td>
<td>SMRWA, MD DNR, St. Mary’s County, NRCS, SCD</td>
<td>Long term</td>
<td>3</td>
</tr>
<tr>
<td>Wetland Restoration</td>
<td>Watershed Wide</td>
<td>St. Mary’s County, NRCS, SCD, MD DNR</td>
<td>Long term</td>
<td>6</td>
</tr>
<tr>
<td>Tree Planting</td>
<td>Watershed Wide</td>
<td>St. Mary’s County, NRCS, SCD, MD DNR</td>
<td>Long term</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Agriculture</td>
<td>High Nutrient Areas (Synoptic Survey)</td>
<td>NRCS, SCD, SMRWA, UMD Cooperative Extension</td>
<td>Long term</td>
<td>5</td>
</tr>
<tr>
<td>Agriculture</td>
<td>Watershed Wide</td>
<td>NRCS, SCD, SMRWA</td>
<td>Long term</td>
<td>4</td>
</tr>
<tr>
<td>Education</td>
<td>Watershed Wide</td>
<td>SMRWA</td>
<td>Short term</td>
<td>1, 2</td>
</tr>
<tr>
<td>Growth</td>
<td>County wide</td>
<td>SMRWA, St. Mary’s County, CWP</td>
<td>Long term</td>
<td>2, 4</td>
</tr>
<tr>
<td>Growth</td>
<td>County wide</td>
<td>SMRWA</td>
<td>Long term</td>
<td>2, 4</td>
</tr>
<tr>
<td>Stormwater</td>
<td>County wide</td>
<td>SMRWA, St. Mary’s County</td>
<td>Long term</td>
<td>4, 5</td>
</tr>
<tr>
<td>Stormwater</td>
<td>Watershed Wide</td>
<td>St. Mary’s County, CWP, UM Sea Grant Extension</td>
<td>Long term</td>
<td>4, 5</td>
</tr>
</tbody>
</table>

Table 11-2, cont. Goals, locations, responsible parties, and milestones set for restoration recommendations in the St. Mary’s River watershed. Table from the Center for Watershed Protection, St. Mary’s River Watershed Plan.
REFERENCES

Section 1: Executive Summary


Watershed Report for Biological Impairment of Non-Tidal St. Mary’s River Watershed, St. Mary’s County, Maryland Biological Stressor Identification Analysis Results and Interpretation. 2014. Maryland Department of the Environment.


Section 4: Heritage


Newell RIE. "Ecological changes in Chesapeake Bay: are they the result of overharvesting the eastern oyster (Crassostrea virginica)?" Chesapeake Research Consortium 129: 536–546 (1988).


REFERENCES

Section 5, cont.


Maryland Department of Natural Resources. “Breton Bay Characterization; October 2001.” Maryland Department of Natural Resources, Chesapeake and Coastal Watershed Service, in partnership with St. Mary’s County and the Town of Leonardtown; page 7


REFERENCES

Section 5, cont.


Section 6: Landscape and Land Use


REFERENCES

Section 6, cont.


REFERENCES

Section 6, cont.

Maryland Department of Natural Resources, Annapolis, Maryland.


Maryland Department of the Environment. “Prioritizing Sites for Wetland Restoration, Mitigation, and Preservation in Maryland, St. Mary’s County.” 2006. Maryland Department of the Environment.


Section 7: Landscape and Land Use


“St. Mary’s County Transit Development Plan Final Report.” 2013. KFH Group, Inc. Prepared for St. Mary’s County and Maryland Transit Administration.

Maryland Department of the Environment. “Watershed Report for Biological Impairment of Non-Tidal St. Mary’s River Watershed, St. Mary’s County, Maryland Biological Stressor Identification Analysis Results and
REFERENCES

Section 7, cont.

Interpretation.” 2014.


REFERENCES

Section 7, cont.

Natural Resources Conservation Service. “Soil Survey of St Mary’s County, Maryland. 1978.” United States Department of Agriculture, Natural Resources Conservation Service (formerly Soil Conservation Service), in cooperation with Maryland Agricultural Experiment Station.


Section 8: Housing and Welfare


Health Resources in Action. “St. Mary’s County, MD: Local Qualitative Health Needs Assessment on Substance Abuse Prevention and Response/Opioid Misuse Prevention Assessment.” 2015. Produced for St, Mary’s County Health Department.


REFERENCES

Section 8, cont.


“Maryland Opioid Overdose Prevention Plan.” Adopted January 2013. 20 pages


Drummond, David D. “Water Supply Potential of the Coastal Plain Aquifers in Calvert, Charles, and St. Mary’s Counties, Maryland, with Emphasis on the Upper Patapsco and Lower Patapsco Aquifers.” Maryland Department of Natural Resources Resource Assessment Service; June 2005.


Department of Public Safety. “St. Mary’s County Multi-Jurisdictional Hazard Mitigation Plan.” 2011.


Section 9: Restoration and Conservation Targeting


REFERENCES


Maryland Department of Natural Resources. “Fish Passage.” Website: http://dnr2.maryland.gov/fisheries/Pages/fishpassage/index.aspx (accessed December 2014).

REFERENCES


Section 10: Projects Related to the WRAS Process


Section 11: Potential Benchmarks for WRAS Goal-Setting


Map 1  Regional Context
S. Mary's River Watershed in St. Mary's County Watershed Restoration Action Strategy (WRAS) Area

Key:
- St. Mary's River Watershed / WRAS area
- Potomac River Basin in Maryland
- Maryland State Boundary
- Water

Baltimore City
Washington, DC
Map 4 Subwatershed Study Areas
St. Mary's River Watershed - 02140103

Key:
- St. Mary's River Watershed
- Streams
- Primary Roads
- St. Mary's Lake
- Nontidal Wetlands
- Tidal Wetlands
- Tidal Water

Areas with Subwatershed studies
- Hilton Run Management Plan, Study Area (SMRWA, 2003)
- Watershed Assessment Plan for SMR: Study Area (KCI 1998)

Note: Subwatershed names are suggestions. 12-Digit number designation is a unique identifier in a state wide system.
Map 5 Designated Use
St. Mary's River Watershed - 02140103

Key:
- St. Mary's River Watershed
- Primary Roads
- Other roads
- Tidal Wetlands

Use Designations:
- Streams: Use 1 for water contact recreation, protection of aquatic life
- St. Mary's Lake: Use 1 for water contact recreation, protection of aquatic life
- Tidal Waters: Use 2 for Shellfish harvesting
- Restricted waters: No shellfish harvesting
- Conditionally approved waters: Oyster and clam harvesting is allowed except for three days following a rainfall event of one inch or greater

Sources:
Use Data: http://www.mde.state.md.us/programs/Water/TMDL/Water%20Quality%20Standards/Pages/DesignatedUsesMaps.aspx
Harvest area data: http://www.mde.state.md.us/programs/lander/CitizensInfoCenterHome/Pages/citizensinfo/hsh/shellfishmaps.aspx
Map 8 MDE Permits
St. Mary's River Watershed - 02140103

Key:
- St. Mary's River Watershed
- Subwatershed boundaries
- Streams
- Primary Roads
- Other roads
- Nontidal Wetlands
- Tidal Wetlands
- Tidal Water

Permit Category
- Waste Water Treatment system
- Mineral Mine
- Aquaculture
- Other
- Stormwater Discharge

Source: MDE iMap 2013 data. Note: Permitees identified by number in table associated with this map.

10,000 5,000 0 10,000 Feet
MAP 10 Aquia Aquifer

Sources: Power Plant Assessment Program of the Maryland Department of Natural Resources and the Maryland Geological Survey. Scientific Investigations Report 2012-5165 Figure 3; Potentiometric surface of the Aquia aquifer in Southern Maryland and Maryland's Eastern Shore, September 2011.
Map 13 Forest Interior Habitat
St. Mary's River Watershed - 02140103

Key:
- St. Mary's River Watershed
- Subwatershed boundaries
- Streams
- Primary Roads
- Tidal Wetlands
- Tidal Water

Forest Interior Dwelling Species (FIDS) Habitat
- High Quality FIDS Habitat
- Other FIDS Habitat

Source: MD DNR

NOTE: "FIDS" are species that require large forest areas with sufficient forest interior to breed successfully and maintain viable populations. While a number of species need forest interior habitat, 19 species of birds are the FIDS most often tracked by Maryland programs.
Map 14 Protected Lands and Smart Growth
St. Mary's River Watershed - 02140103

Key:
- St. Mary's River Watershed
- Streams
- Primary Roads
- Tidal Wetlands
- Tidal Water

Land Status
- Designated Growth Areas
- Priority Funding Areas
- Land Protected by easements (MALPF, MET, MHT, TDR's, etc)
- Parks and Recreation Facilities
- Airport
- Landfill
- County Facilities
- State-owned land
- Federally-owned Land
- Open space in developments
- Planned Open space

Source: DLUGM 2015, and MDP PropertyView Data base
Map 15 Soils by Natural Soils Groups
St. Mary's River Watershed - 02140103

Key:
- St. Mary's River Watershed
- Subwatershed boundaries
- Streams
- Primary Roads
- Tidal Wetlands
- Tidal Water

Prime Farmland Soils
- B1a - well drained, moderately erodible
- E1a - moderately well drained, low erodibility
- E3a - moderately well drained, high erodibility, slopes<10%
- E3 - moderately well drained, high erodibility

Other well drained soils
- A1a, A1b - sandy, excessively well drained
- B1b, B1c - well drained, 8% and greater slope
- B2a, B2b - well drained, slow permeability

Soils limited by wetness
- E2a - seasonally wet/dry, perched water table
- F2 - acidic, hydric
- F3 - hydric, clayey
- G2 - floodplain, wet
- G3 - marsh, swamp

Other categories
- Borrow pit, Made land, and Unclassified
- Water (St. Mary's Lake)

Source: MDP Natural Soils Groups

There are two MDP Natural Soils Groups map numbering.
Map 18 Floodplain and Storm surge
St. Mary's River Watershed - 02140103

Key:
- St. Mary's River Watershed
- Streams
- Primary Roads
- Water

**Floodplains**
- Regulatory (100-year)
- 2% Annual Chance Floodplain

**SLOSH Model Hurricane Surge (ACOE)**
- Category 1 Storm Surge
- Category 2 Storm Surge
- Category 3 Storm Surge
- Category 4 Storm Surge
- Category 5 Storm Surge

**Other Modeled Storm Surge areas (Towson)**
- Category 4 storm
- Category 3 storm
- Category 2 storm
- Category 1 storm
- Category 0 storm

Source: Floodplains--MD iMAP, MDE, ACOE
Surge--ACOE, Towson University

10,000 5,000 0 10,000 Feet
Map 19 Oysters in the St. Mary's River

Natural Oyster Bars: Areas delineated to protect and manage oyster and other habitats including natural oyster bars. Maps were last updated in 1983.

St. Mary's River Watershed
Tidal water

Oyster Bars (CC Yales Survey 1906-1912) Extent of oyster habitat/populations identified by oysters or by other means usually or with poles, chains, or other implements.

Source: MD MERLII data

Scale: 10,000 Feet
Map 21 Submerged Aquatic Vegetation
St. Mary's River Watershed - 02140103

SAV Surveys
2013 SAV Beds
- <10% Coverage
- 10 to < 40% coverage
- 40 to < 70% coverage
- 70 to 100% coverage
- Extent of 2010 SAV beds

St. Mary's River Watershed
Tidal water

Source: Virginia Institute of Marine Science
2013 Chesapeake Bay SAV Coverage
http://web.vims.edu/bio/sav/

5,000 0 5,000 Feet