QUEEN ANNES COUNTY

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Background

This County has about 238,720 acres and 258 shoreline miles (QA, 2002). During the 2000 U.S. Census, there were 40,563 people. It is estimated there will be roughly 55,800 people by 2020. Soils are described in the USDA soil survey as follows:

> The southwestern part of Queen Anne's County, which includes the Kent Island/Grasonville area, is made up of nearly level lowland flats that are characterized by windblown materials overlying alluvial and marine sediments. Most of the tidal marshes are in this part of the County, and many of the upland soils have seasonal high water tables near the surface. The central part of the County is nearly level to strongly sloping with dominantly alluvial sediments and well-drained soils. Along the Chester River terrace, the soils are sandy and, in some areas, excessively drained. The landscape in the northeastern portion of the County, along the Caroline County line and the Delaware State line, is dominated by closed circular depressions known as potholes, whale wallows, or Delmarva bays. The soils are poorly drained or very poorly drained, and many manmade ditches dissect the cropland.

This County has the largest acreage of prime farmland of all the Maryland Counties. Approximately 36% of the land is hydric soils. Agriculture is very important to this County. In order to preserve agriculture in the County, wetland restoration/creation should attempt to avoid areas classified as prime farmland. Main mineral deposits include sand and gravel in the eastern portion of the County (QA, 2002).

Most wells withdraw from the confined Aquia aquifer. Restrictions on new wells withdrawing this aquifer has led to more dependence on the confined Magothy aquifer. The unconfined aquifer is used near Love Point and east of Queenstown Creek/Wye River. There has been some reported saltwater intrusion at Love Point on Northern Kent Island and brackish water intrusion along western Kent Island (QA, 2002). In addition to saltwater intrusion, the unconfined aquifer is susceptible to contaminants from livestock, sewage systems, and fertilizer (NRCS, 2002). About 5-10% of wells in the Kingstown/Chester area have nitrate levels exceeding allowable standards (10mg/L). Kent Island has some failing septics, with nutrients entering the Chesapeake Bay.

Over half of the land use in Queen Anne's County is agriculture (63%), about a quarter is forest (27%), and smaller amounts are developed land (9%) and wetland (2%) (based on MDP 2002 land use GIS data). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR. The concentration of developed land is higher in the western portion of the County.

Queen Anne's County drains into two different State-designated 6-digit watersheds: Choptank River (021304) and Chester River (021305). The 8-digit watersheds within the Queen Anne portion of the Choptank River watershed include: Upper Choptank (02130404) and Tuckahoe Creek (02130405). The 8-digit watersheds within the Queen Anne portion of the Chester River watershed include: Eastern Bay (02130501), Wye River (02130503), Kent Narrows(02130504), Lower Chester River(02130505), Corsica River (02130507), Southeast Creek(02130508), Middle Chester River(02130509), Upper Chester River(02130510), and Kent Island Bay (02130511).

Streams

The following information is from the Maryland Tributary Strategies 2004 document entitled *Maryland Upper Eastern Shore: Final Version for 1985-2002 Data*. This basin drains Kent County and portions of Talbot, Queen Anne, and Cecil Counties and includes the waterways Miles, Bohemia, Elk, Chester, Sassafras and Northeast Rivers, Eastern, Crab Alley, and Prospect Bays. Land use is dominated by agriculture (58%), forest/wetland (32%), and urban (10%). Roughly 60-70% of the houses are on septic. Of the six major wastewater treatment plants, all either currently have or will have biological nutrient removal by 2005. The major source for nitrogen, phosphorus, and sediments is agriculture (74%, 73%, and 89% respectively). Water quality sampling found nitrogen, phosphorus, and total suspended solids to be good or fair, except in the Upper Chester River which had the worst water quality. In 2001, SAV coverage exceeded the SAV goal at Bohemia, Elk Neck, Sassafras, and Back Creek but was below the SAV goal at Northeast, Chester, and Eastern Bay. The benthic community was the worst at Northeast River, Bohemia River, and Eastern Bay. This document describes BMP implementation success as follows:

> BMP implementation for conservation tillage, cover crops, retirement and treatment of highly erodible land, stream protection, and erosion and sediment control are all making good progress toward Tributary Strategy goals. For other BMPs, such as those for animal waste management systems, forested and grassed buffers, and stormwater management measures, progress has been slower, and in some cases, nonexistent.

The following information is based on the Maryland Tributary Strategies 2004 document entitled *Choptank River Basin Summary: Final Version for1985-2002 Data*. The Choptank River basin includes land in Caroline, Dorchester, Queen Anne's and Talbot Counties. The basin supports over 80 fish species and the bottom section of the basin is important for waterfowl. This basin has a large amount of agriculture (58%) and a high number of agricultural ditches. Roughly half of the houses are on septic systems. Main water quality impairments are from non-point nutrients and sediments. In 2002, the main nitrogen, phosphorus, and sediment sources within the Choptank River basin were from agriculture (73%, 67%, and 87%, respectively). Based on tributary stations, nitrogen, phosphorus, and sediments were generally better at the mouth of the Little Choptank and Choptank Rivers than upstream Choptank River. In 2001, SAV along the Choptank River from Castle Haven Point to Bow Knee Point was much lower than the SAV goal, SAV in the outer Choptank River was roughly three-quarters of the SAV goal, and SAV in the

Little Choptank River exceeded the SAV goal. The benthic community was generally good, but there were some differences in the different areas. Some samples within the lower mesohaline portion were slightly degraded, the upper mesohaline portion were moderately to severely degraded (due to nutrient enrichment, with many poor sites upstream of Cabin Creek), and the oligohaline portion was the best. This document describes the mixed success of BMP implementation as follows:

> In some cases, such as shore erosion controls, forest conservation, forest buffers, and nutrient management plans, the goals set in the Choptank Tributary Strategy have nearly been met or have been exceeded. For other BMPs, notably those dealing with stormwater management, implementation is falling short of the Tributary Strategy goals.

Wetlands

Wetland Classifications

According to Tiner and Burke (1995), in 1981-1982 there were 32,511 acres of wetlands (5.4% of the State's total). The wetland types were Estuarine (8,453 acres), Palustrine (24,040 acres), Riverine (13 acres), and Lacustrine (5 acres). Comparisons of this 1981-1982 wetland acreage with historic wetland acreage (based on hydric soils) represents a 63%, or 54,418 acre, loss (MDE, 2002a).

A survey of wetland trends from 1982-1989 was conducted by the U.S. Fish and Wildlife Service in part of Queen Anne's County. The study area was the U.S. Geological Survey quadrangles in Kent Island and Queenstown. During the time period in the sample, approximately 88 acres of vegetated wetlands were converted to uplands. Over 60 of these lost acres were formerly estuarine emergent wetlands. Housing construction was the cause of wetland loss. Commercial development, agriculture, and road/highway construction also resulted in greater than 10 acres of loss respectively. The report anticipated that remaining wetlands would be degraded due to runoff, increased sedimentation, ground water withdrawals, and water pollution (Tiner and Foulis, 1993).

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

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

smooth cordgrass-short form, Olney three-square, switchgrass, common three-square, big cordgrass, common reed, salt marsh bulrush, seaside goldenrod, rose mallow, and narrow-leaved cattail.

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

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

- Palustrine wetlands can be classified into four major groups depending on the dominant vegetation type: forested, scrub-shrub, emergent, and aquatic. These wetlands were described for the Maryland Coastal Plain Province.
  - Palustrine forested wetlands are the dominant palustrine wetland type on the Coastal Plain and are located in floodplains, depressions, and drainage divides. They can be classified into four main groups:
    - Tidally flooded wetlands are freshwater wetlands that are tidally influenced. Common tree species may include red maple, green ash, black willow and black gum.
    - Semipermanently flooded wetlands are nontidal wetlands that are flooded for much of the growing season. These are uncommon in Maryland. Some examples, dominated by bald cypress, are along Battle Creek and the Pocomoke River. Higher elevations may be dominated by red maple, black gum, sweet bay, swamp black gum, fringe tree, ironwood, and swamp cottonwood.
    - Seasonally flooded wetlands are nontidal wetlands that are flooded for generally longer than two weeks during the growing season. Some of the more common tree dominants include red maple, sweet gum, pin oak, willow oak, loblolly pine, or swamp chestnut oak. There is often a thick shrub understory. Atlantic white cedar swamps may have been located historically in Queen Anne's County (Upper Chester River) (Dill et al., 1987). Few Atlantic white cedar swamps remain in Maryland since most have been converted to hardwood swamp.
    - Temporarily flooded wetlands are nontidal wetlands that are flooded the least of the four types, about a week. Seasonally saturated wetlands, wetlands having a high water table during the

cooler months, are also included in this category. Some of these areas are managed for loblolly pine harvesting. Other tree dominants include red maple, sweet gum, black gum, willow oak, water oak, basket oak, swamp white oak, southern red oak, sycamore, black willow, American holly, sweet bay.

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

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

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

Tidal wetland acreage was also estimated in *The Coastal Wetlands of Maryland* (Table 1). Queen Anne's County had 3,422 acres of vegetated tidally-influenced wetlands (excluding SAV), mainly brackish high marsh. Brackish marsh often has lower species richness and species diversity than fresh tidal marsh, due to the stress of higher salinity levels. Brackish marsh may also have quite distinct plant zonation patterns.

Table 1. Tidal wetland acreage within Queen Anne's County based on vegetation type (McCormick and Somes, 1982).

Major Vegetation Type	Vegetation Type	Acreage
Shrub Swamp *(Fresh)*	Swamp rose	0
	Smooth alder/Black willow	0
	Red maple/Ash	4
Swamp forest *(fresh except pine, which is often brackish)*	Bald cypress	0
	Red maple/Ash	7
	Loblolly pine	0
Fresh marsh	Smartweed/Rice cutgrass	7
	Spatterdock	0
	Pickerelweed/Arrow arum	86
	Sweetflag	0
	Cattail	152
	Rosemallow	9
	Wildrice	0
	Bulrush	0
	Big cordgrass	23
	Common reed	9
Brackish High Marsh	Meadow cordgrass/Spikegrass	935
	Marshelder/Groundselbush	897
	Needlerush	281
	Cattail	493
	Rosemallow	15
	Switchgrass	18
	Threesquare	65
	Big cordgrass	212
	Common reed	105
Brackish Low Marsh	Smooth cordgrass	104
Saline High Marsh	Meadow cordgrass/Spikegrass	0
	Marshelder/Groundselbush	0
	Needlerush	0
Saline Low Marsh	Smooth cordgrass, tall growth form	0
	Smooth cordgrass, short growth form	0
Submerged Aquatic Vegetation	Submerged aquatic plants	4,228

The 1984 document entitled *Uncommon Wetlands in the Coastal Plain of Maryland* describes the eastern shore potholes, including some in northeastern Queen Anne's County, as being uncommon. These wetlands are generally isolated depressions around

the Maryland-Delaware border in Kent, Queen Anne's, and Caroline Counties. These seasonal ponds are often surrounded by forest. They are ponded in the spring and relatively dry in late summer and fall. Ponded areas may have no vegetation during the wet season but may have herbaceous vegetation during the drier season. Vegetation types include glades, shrub swamp, and forested swamp. Glades are the least common and are dominated by herbaceous vegetation often including a grass (*Erianthus giganteus*), sedge (*Carex walteriana*), twig-rush (*Cladium mariscoides*), smartweeds (*Polygonum* sp.), and sphagnum moss beneath. The shrub swamps may be dominated by *Cephalanthus occidentalis* and *Decodon verticillatus* but may have abundant herbaceous vegetation during certain seasons. The forested swamp may be dominated by *Acer rubrum*, *Liquidambar styraciflua*, *Quercus palustris*, and *Q. phellos*. Multiple vegetation types may be present at the same site. These sites may act as ecological "islands" being very important habitat for amphibians, invertebrates, and rare species including the Carpender frog. These wetlands are vulnerable to drainage, conversion to agriculture, and clearing of the surrounding buffer. Altering the existing hydrology or hydrological fluctuations would be detrimental to the system. Examples of these sites are: northeast of Rte. 302, on the south side of Busicks Church Road, and near Carson Corner. In order to protect some of these important systems, Sipple (1999) recommended acquiring sites "preferably where representative examples of each type occurred in a matrix of upland forest." Due partly to the abundance of Delmarva bays in this region, they are also important for local flood attenuation and provide groundwater recharge during drier seasons (Brown and Jung, 2005).

Wetland Functions

Stormwater and Flood Control

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

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

position of the wetland in the watershed and the ratio of size of the wetland to the size of the watershed also affect the function. Wetlands higher in the landscape and of large in size in relation to the watershed are most effective. While wetlands retain surface flows that enter the wetlands at a gradual rate, they are considered to be more effective at reducing damages from short duration storms.

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

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

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

Groundwater Recharge and Discharge

Functions

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

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

Values

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

Studies have been conducted on the groundwater recharge/discharge processes in the isolated seasonal pond wetlands and Delmarva Bays of the type found in this County. Phillips and Shedlock (1993) found that unlike may areas, the ground water table around these wetlands did not mimic surface topography and the flow reversed direction throughout the year. The water table adjacent to and beneath the wetland was higher than

in nearby ridges, from August through January, the water table was highest in the ponds and sloped downward into the upland ridges. From February through May, the water table was nearly level. However, during dry periods in this time, the water table was higher in the uplands. By the end of May, the water levels were decreasing and again began to assume the form shown in August-January, with water levels in the pond higher than in the pond margin and surrounding upland. Recharge of the surficial aquifer was believed to occur during this time.

Modification of Water Quality

Water Quality Improvement

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

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

Hydrophytic vegetation (adapted to live in water) and microbial activity in soils help remove toxic substances and excess nutrients from surface water. Dissolved solids and other constituents may be removed or degraded, such that they become inactive, or incorporated into biomass. This occurs through adsorption and absorption by soil particles, uptake by vegetation and loss to the atmosphere through decomposition and exchange between atmosphere and water.

Nutrient Cycling: Addition, Removal and Transformation

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

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

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

Nitrogen undergoes some chemical transformations and may be taken up in soluble form, absorbed by plants through their roots, or consumed by anaerobic microorganisms that convert the nitrogen to organic matter (Mitsch and Gosselink, 2000). Anaerobic microbes may also convert the nitrogen from a nitrate form to nitrogen gas. Phosphorus is often bound to clay particles, and these fine sediments are transported into wetlands by riparian

flooding and tidal action. Phosphorus may be stored in a wetland attached to the clay particles, however, phosphorus becomes available for plant uptake in its soluble form after flooding, saturation and anaerobic conditions typical of a wetland occur. Nutrient processes vary seasonally. Cooler temperatures slow microbial activity and plant uptake while higher flows of water transport more materials out of non-isolated wetland systems. The transported organic material is critical for downstream food chain support.

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

Wetlands are most effective at nutrient transformation and uptake when there are seasonal fluctuations in water levels (Tiner and Burke, 1995). Wetlands that are temporarily flooded (saturated or inundated for brief periods early in the growing season) and those that are permanently inundated would generally be less effective than seasonally wet areas (saturated or inundated for longer periods during the early-mid growing season but are drier by the end of the growing season).

Toxics Retention

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

Sediment Reduction

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

Lack of dense vegetation in some floodplains, and narrow width of floodplains, would reduce the ability of wetlands to slow velocities of floodwaters and allow settling of transported sediments.

Wildlife Habitat/Biodiversity

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

Nontidal Wetlands of Special State Concern

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

General Wetland Restoration Considerations

Hydric soils suggest where wetlands are currently or were historically. There is a fair amount of hydric soil that is not mapped wetlands (based on NRCS SSURGO GIS data and NWI/DNR wetlands). While the majority is classified as "poorly drained," there are some areas of "very poorly drained" soils. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration.

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

Vegetated stream buffers have the potential to intercept and remove nutrients, sediments, and other pollutants. Peterson et al. (2001) found that the smallest headwater streams, which are often found in association with springs and groundwater discharge wetlands, have the most rapid uptake and transformation of inorganic nitrogen (ammonium and nitrate) in comparison with other surface waters. The authors believed that the large surface to volume ratio in small streams resulted in rapid nitrogen uptake and processing. An excess of discharges to overload these systems would result in nitrogen being transported farther down the drainage systems to rivers and estuaries. Forested stream buffers can also improve down steam biodiversity by contributing organic matter to the food web, providing woody debris which increases diversity of physical habitat, and

reducing stream temperature. Headwater streams are thought to be the most beneficial at these processes. Therefore, wetlands adjacent to streams should be high priority for restoration/preservation, with emphasis on headwater stream systems. Wetlands around all tributaries of waterways used for drinking water (COMAR Use P) should also be ranked higher.

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

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

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

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

Sensitive Resources

MDE completed source water assessments for 15 community water supplies in this County. Most of these are not susceptible to human-induced contamination since they withdraw from confined aquifers. Most withdrawing from the Aquia aquifer are susceptible to contamination by arsenic. Some systems are susceptible to contamination by radon. The systems are discussed in the individual watersheds.

Sensitive areas requiring special consideration according to the 1992 Planning Act include: streams and their buffers, 100-year floodplain, threatened and endangered species habitats, and steep slopes. 17% of the County is within the Chesapeake Bay Critical Area (QA, 2002). DNR mapped locations of the following endangered species within the County:

- Bald eagle
- Delmarva Fox squirrel
- Waterbird nesting sites and waterfowl staging areas

- Oyster bars
- Anadromous fish spawning areas
- Submerged Aquatic Areas

The County also proposes to develop a strategy to place wetland mitigation, including mitigation banks, adjacent to critical areas. Two subdivisions needing this type of planning are Bay City and Cloverfields.

The Corsica River Pilot Project will focus resources on restoring the Corsica River watershed, so it can be removed from the list of impaired waters.

Other Relevant Programs

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

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

Natural Heritage Areas
There are no State-designated Natural Heritage Areas (NHA) located in this County.

Rural Legacy Program
State-designated Rural Legacy area is located along the Chester River and north of Church Hill (watersheds Lower, Middle, and Upper Chester River, and smaller amounts in Corsica River and Southeast Creek). For more detailed information refer to the specific watershed sections.

Priority Funding Areas
Most of the Priority Funding Areas are focused around the Chesapeake Bay Bridge and Rte. 50 (to the Rte. 301 split). Centerville is another large PFA and other smaller ones are scattered.

Stakeholders in wetland management may have conflicting goals for wetlands in Priority Funding Areas. Some may advocate preserving wetlands in these areas as greenways, for aesthetics, or as unique communities in a developing area. Other interests may seek

flexibility and expedited review of proposals to impact wetlands due to other goals for growth and economic development in a designated area. There may be benefits to protecting and restoring wetlands for water quality in a growth area, particularly as an offset against future or existing TMDLs. Preservation of biodiversity may be more of a challenge due to possible increases in nonpoint source pollution and fragmentation. Stormwater management associated with growth may also reduce certain nonpoint source impacts to wetlands in PFAs.

Protected Areas
Small parcels of protected land is scattered throughout the County, with the largest areas being Wye Island NRMA and Tuckahoe State Park.

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

Watershed Information

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

Upper Choptank (02130404)

Background

The Queen Anne's portion of this watershed has 1,912 land acres (based on MDP 2002 land use GIS data). Land use is dominated by agriculture (53%) and forest (45%), with a small amount of developed land (2%). Since MDP wetland estimates may be grossly underestimated, better wetland estimates can be generated from DNR wetlands data (as discussed below).

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

- Estuarine
    - Emergent: 3,265 acres
    - Scrub shrub: 2 acres
    - Unconsolidated shore: 109 acres

- Palustrine
    - Aquatic bed: 2 acres
    - Emergent: 519 acres
    - Scrub shrub: 931 acres
    - Forested: 10,045 acres
    - Unconsolidated bottom: 604 acres
    - Farmed: 620 acres
- Riverine unconsolidated shore: 176 acres
- Total: 16,272 acres

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

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130404	-6.27	1.06	80.00	12.59	87.38

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

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. It is also classified as a Category 3, a watershed in need of protection. Failing indicators include high modeled phosphorus loads, low SAV habitat index, low tidal benthic IBI, low non-tidal benthic IBI, high historic wetland loss (48,169 acres), high soil erodibility (0.28), and being on the 303(d) List for water quality impairments. Indicators for Category 3 include a high imperiled aquatic species indicator and six migratory fish spawning areas.

According to the 2002 Maryland Section 305(b) Water Quality Report, the tidal and nontidal Upper Choptank River and tidal tributaries fully supports all designated uses (14.1 mi.^{2}). Nontidal wadeable tributaries fail to support all designated uses (127.5 mi.) due to poor biological community from siltation, low oxygen, channelization and changes in hydrology.

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

- *Upper Choptank* (tidal); nutrients, suspended sediment.
- *Choptank River Unnamed Tributary 1* (021304040487 non-tidal in Caroline); poor biological community.

- *Choptank River Unnamed Tributary* (021304040496 non-tidal in Caroline); poor biological community.
- *Miles Creek Unnamed Tributary* (021304040473 non-tidal in Talbot); poor biological community.
- *Beaverdam Branch* (021304040483 non-tidal in Talbot); poor biological community.
- *Herring Run Unnamed Tributary* (021304040490 non-tidal in Caroline); sedimentation.
- *Broadway Branch* (021304040509 non-tidal in Caroline); poor biological community.
- *Forge Branch* (021304040505 non-tidal in Caroline); poor biological community.
- *Forge Branch Unnamed tributary* (021304040505 non-tidal in Caroline); poor biological community.
- *Forge Branch Unnamed tributary* (021304040504 non-tidal in Caroline); sedimentation.
- *Oldtown Branch* (021304040508 non-tidal in Caroline); poor biological community.
- *Oldtown Branch Unnamed Tributary 1* (021304040508 non-tidal in Caroline); poor biological community.
- *Fowling Creek Unnamed Tributary 1* (021304040485 non-tidal in Caroline); poor biological community.
- *Harrington Beaverdam Ditch Unnamed Tributary 1* (021304040515 non-tidal); poor biological community.
- *Tidy Island Creek* (021304040512 non-tidal in Caroline); poor biological community.
- *Tidy Island Creek Unnamed Tributary* (021304040509 non-tidal in Caroline); sedimentation.
- *Tidy Island Creek Unnamed Tributary 1* (021304040514 non-tidal in Caroline); poor biological community.
- *Coolspring Branch* (021304040514 non-tidal in Caroline); poor biological community.
- *Robins Creek Unnamed Tributary* (021304040486 non-tidal in Caroline); poor biological community.
- *Andover Branch Unnamed Tributary* (021304040515 non-tidal); poor biological community.

The only MBSS site within the Queen Anne portion of this watershed had a BIBI of very poor.

Restoration/Preservation

Of the small amount of Upper Choptank watershed that is within Queen Anne's County, most is within the Green Infrastructure network but is unprotected. It is desirable to protect these areas. There are also some Green Infrastructure "gaps" in natural vegetation. These areas may be good locations for restoration to natural vegetation.

There is one State-designated Nontidal Wetland of Special State Concern (WSSC) within the Queen Anne portion of this watershed. Templeville Ponds contains two Delmarva bays dominated by herbaceous vegetation. They contain a State Endangered, and also a candidate for Listing under the U.S. Endangered Species Act, and an uncommon plant species. Surveys conducted during different seasons may reveal additional RTE species. This site is within a large forest. Delmarva bays are seasonal groundwater fed ponds that provide unique habitat and therefore often rare plant and animal species. These bays were once more common on the Eastern Shore, but many have been destroyed due to drainage and filling for agriculture and development (DNR, 1991). It is currently unprotected.

Specific Restoration Recommendations

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

Specific Preservation Recommendations

- Protect wetlands and streams within the headwaters.
- Protect currently unprotected Green Infrastructure, especially around waterways.
- Protect any portions of the WSSCs and surrounding buffer that are not currently protected.

<u>Tuckahoe Creek (02130405)</u>

Background

There are roughly 45,960 land acres in the Queen Anne's portion of this watershed (based on MDP 2002 land use GIS data). Land use is dominated by agriculture (72%), with smaller amounts of forest (27%) and developed land (2%). Since MDP wetland estimates may be grossly underestimated, better wetland estimates can be generated from DNR wetlands data (as discussed below).

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

- Estuarine
    - Emergent: 44 acres
    - Unconsolidated shore: 2 acres
- Palustrine
    - Emergent: 724 acres
    - Scrub shrub: 283 acres
    - Forested: 10,898 acres
    - Unconsolidated bottom: 270 acres
    - Farmed: 1,023 acres
- Riverine
    - Emergent: 21 acres
    - Unconsolidated shore: 33 acres

- Total: 13,298 acres

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

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130405	-1.44	1.12	2.30	0	1.98

An emergent wetland of 1.3 acres was created in an agricultural field as programmatic mitigation site was constructed in this watershed in 1993-94.

Numerous acres of Delmarva Bays and other Nontidal Wetlands of Special State Concern were managed for invasive species control as a programmatic mitigation project in this watershed. Sites were initially treated in 2002 and 2003 and monitoring will continue for five years.

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

Water Quality

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. Since it is a "Priority" Category 1 watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. It is also classified as a Category 3, a watershed in need of protection. Failing indicators include high modeled nitrogen and phosphorus loads, low non-tidal benthic IBI, high historic wetland loss (35,689), high percent stream buffer unforested (63%), high soil erodibility (0.30), and being on the 303(d) List for water quality impairments. Indicators for Category 3 include a high non-tidal fish IBI, a high imperiled aquatic species indicator, and six migratory fish spawning areas.

According to the 2002 Maryland Section 305(b) Water Quality Report, water quality results for the tidal portion of the Tuckahoe Creek were inconclusive. A portion of the nontidal wadeable tributaries (unnamed tributary to Tuckahoe Creek, Blockston Branch, Mason Branch, unnamed tributary to Mason Branch; DNR,2000) failed to fully support all designated uses (2.5 mi. fully support, 31.1 mi. fail to support, 56.8 mi. were inconclusive) due to a poor benthic community. Possible reasons for this poor community include low dissolved oxygen, siltation, changes in habitat, channelization, and sewer/septic systems. Tuckahoe Lake (86.0 acres) fully supports all designated uses.

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

- *Tuckahoe Creek*; nutrients, suspended sediments.
- *Tuckahoe Creek Impoundment*; While methylmercury in fish tissue (from atmospheric deposition) is an impairment to this waterway, a TMDL has been completed for this contaminant.
- *Unnamed tributary to Tuckahoe Creek* (021304050517 in Talbot); sedimentation.
- *Blockston Branch* (021304050529 in Queen Anne); sedimentation.
- *Mason Branch* (021304050534); sedimentation.
- *Mason Branch* (021304050537); sedimentation.
- *Unnamed tributary to Mason Branch* (021304050536 in Queen Anne); poor biological community.

MDE completed a TMDL for mercury in Tuckahoe Lake, as summarized below. Tuckahoe Lake lies on Tuckahoe Creek, west of Ridgely. It is owned by DNR and is within Tuckahoe State Park. It is designated Use I – water contact recreation and protection of aquatic life. Since MDE has issued a fish consumption advisory for fish from this lake, due to high levels of mercury in fish tissue, it does not support the designated use. Since the main source of mercury is atmospheric, high mercury levels are common throughout the State. While some sources of mercury are within the State, many come from outside the State. EPA estimates that coal-fired electric power plants generate the largest amount of mercury. Maryland atmospheric sources are: power plants (43%), municipal waste combustors (31%), medical waste incinerators (19%), Portland Cement plants (6%), other (1%). It is estimated that enforcement of proposed and existing Clean Air Act regulations will help in the implementation of the mercury TMDL.

MBSS found BIBI of fair to very poor, while FIBI was generally ranked as good.

Restoration/Preservation

This watershed has Green Infrastructure hubs and corridors spread throughout, including along some of the waterways like Tuckahoe Creek, Norwich Creek, Blockston Branch, German Branch, Mason Branch, Long Marsh Ditch, and Beaverman Ditch. With the exception of Tuckahoe State Park, these areas are unprotected. Some GI "gaps" exist along Mason Branch, Beaverman Ditch, and Long Marsh Ditch that would provide desirable areas for restoration to natural vegetation. According to the Maryland Greenways Commission, proposed and existing greenways include:

- *Cross County Trail*: a proposed recreational trail connecting Queenstown, Centerville and Tuckahoe State Park
- *Tuckahoe State Park*: an existing ecological and recreational greenway in Tuckahoe State Park.

There are three State-designated Nontidal Wetlands of Special State Concern (WSSC) and one potential WSSC within the Queen Anne portion of this watershed. Information on these wetlands is as follows:

- *Kane Crossroads Pond*. This wetland contains a large seasonal pond with several RTE species. There is one State Endangered plant species, which is a candidate for listing under the U.S. Endangered Species Act, two State Rare plant species, an uncommon plant species, and an amphibian species "in need of conservation." This pond is dominated by herbaceous species in the drier months and is surrounded by a forested swamp. Delmarva bays are seasonal groundwater fed ponds that provide unique habitat and therefore often rare plant and animal species. Due to the seasonal nature of the pond, more surveys conducted during different times of the year may reveal additional rare species. These bays were once more common on the Eastern Shore, but many have been destroyed due to drainage and filling for agriculture and development (DNR, 1991). Since most of the rare plants are closely linked to the pond hydrological fluctuations, the main threat is altering the hydrology through pond drainage, surrounding ditching or development. This wetland is currently unprotected. The forested buffer should also be protected.
- *Tuckahoe Creek North*. This site includes palustrine forest, shrub, and open water wetlands. It is adjacent to and feeds into the Tuckahoe Creek North Natural Heritage Area (NHA). The Tuckahoe Creek riparian habitat contains a State Threatened shrub species. It is likely that Forest Interior Dwelling Bird species also inhabit this site. These nontidal wetlands and uplands act as a buffer for this sensitive species. This wetland provides the functions of filtering sediment and chemicals, flood attenuation, primary productivity, and species diversity. In order to preserve the pristine nature of the Tuckahoe Creek North NHA, it is critical that these wetlands be preserved (DNR, 1991). The majority of this wetland appears to be protected by Tuckahoe State Park.
- *Long Marsh Ditch*. This linear wetland runs along Long Marsh Ditch. It is currently unprotected.
- *Potential WSSC*. There is a large wetland complex along Norwich Creek, running to Hillsboro. This wetland is not currently protected.

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.
- Restore Green Infrastructure "gaps" in natural vegetation, especially along waterways (e.g. along Mason Branch, Beaverman Ditch, and Long Marsh Ditch).

Specific protection recommendations:

- Protect wetlands and streams within the headwaters.
- Protect Green Infrastructure that is currently unprotected, especially along Tuckahoe Creek and other waterways.
- Protect WSSC and surrounding buffers.
- Protect additional wetlands within designated Ecologically Significant Areas.

<u>Eastern Bay (02130501)</u>

Background

The Queen Anne's portion of this watershed is 11,652 land acres (based on MDP 2002 land use GIS data). Over two-thirds of the area is developed land (38%) or agriculture (38%), with the remaining land use being forest (16%), and wetland (8%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR.

Some of the regions highest densities of transient and wintering waterfowl are located in the Eastern Bay. The Eastern Bay has excellent wintering and transient concentration areas of black ducks (Sipple, 1999).

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

- Estuarine
    - Emergent: 1,007 acres
    - Scrub shrub: 54 acres
    - Forested: 19 acres
    - Unconsolidated shore: 174 acres
- Palustrine
    - Emergent: 73 acres
    - Scrub shrub: 111 acres
    - Forested: 1011 acres
    - Unconsolidated bottom: 67 acres
    - Farmed: 80 acres
- Total: 2,598 acres

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

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130501	-6.53	4.03	1.18	0	-1.32

A programmatic mitigation site in an agricultural field near a school in 1992.

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

Water Quality

In a source water assessment, it was determined that the water supply for Phonecia Trailer Park (near Stevensville) is susceptible to arsenic.

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. Failing indicators include a high percent stream buffer unforested (84%) and being on the 303(d) List for water quality impairment.

According to the 2002 Maryland Section 305(b) Water Quality Report, portions of the Eastern Bay and tidal tributaries fail to support all designated uses (68.7 $mi.^2$ support, 17.7 $mi.^2$ fail to support) due to poor benthic community, bacteria, low oxygen, and nutrients from nonpoint, upstream, natural eutrophication and low tidal flushing.

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

- *Eastern Bay*; nutrients, suspended sediment.
- *Little Creek* (021305010429 tidal in Queen Anne's County); fecal coliform.
- *Shipping Creek* (021305010429 tidal in Queen Anne's County); fecal coliform.

A Draft TMDL was completed for fecal coliform within the restricted shellfish harvesting area of Little Creek (MDE, 2005a).

A Draft Water Quality Analysis for fecal coliform was completed for Shipping Creek within Eastern Bay Basin. This WQA found that the water quality criteria for fecal coliform were being met, therefore Shipping Creek does not require a TMDL for fecal coliform (MDE, 2005a).

Restoration/Preservation

This watershed contains a hub along Warehouse Creek and a corridor running east to Horseheads Wetland Center. The GI area is partially protected by METs, but large areas remain unprotected. Some of the "gaps" in the GI network currently in agriculture may provide good locations for restoration to natural vegetation. According to the Maryland Greenways Commission, proposed and existing greenways include:

- *Queen Anne's County Water Trail*: a proposed water trail along the upper Chester River that would extend around Kent and Wye Islands
- *Matapeake Greenway*: a proposed trail connecting Terrapin Beach Park, Matapeake Harbor of Refuge, and Matapeake County Park
- *Cross Island Trail Park*: an existing recreational trail connecting Terrapin Beach Park with Chesapeake Exploration Center and Kent Narrows Pathways

There are no State-designated Nontidal Wetlands of Special State Concern within the Queen Anne's portion of this watershed.

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.

- Restore wetlands within the Little Creek subwatershed designed for fecal coliform removal.
- Restore Green Infrastructure "gaps," largely in agriculture, back to natural vegetation.

Specific protection recommendations:

- Protect wetlands and streams within the headwaters.
- Protect areas within the Green Infrastructure network that are currently unprotected, including around Warehouse Creek and Thompson Creek.
- Protect additional wetlands within designated Ecologically Significant Areas.
- Protect wetlands used as reference sites in the DNR study of tidal wetland vegetative communities (within Warehouse Creek).

Wye River (02130503)

Background

The Queen Anne's County portion of this watershed is roughly 29,602 land acres (based on MDP 2002 land use GIS data). Agriculture is the main land use (67%), followed by forest (24%), developed land (9%) and wetland (1%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR.

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

- Estuarine
  - Emergent: 667 acres
  - Scrub shrub: 24 acres
  - Unconsolidated shore: 134 acres
- Palustrine
  - Emergent: 137 acres
  - Scrub shrub: 186 acres
  - Forested: 3,570 acres
  - Unconsolidated bottom: 225 acres
  - Farmed: 83 acres
- Total: 5,024 acres

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

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130503	-1.68	0	6.00	0	4.32

A forested wetland was restored at Wye Island Natural Resources Management Area as programmatic mitigation.

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

Water Quality

In a source water assessment, it was determined that the water supply for Queenstown is susceptible to arsenic and VOC.

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. Since it is a "Priority" Category 1 watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include a high modeled phosphorus loading, a low non-tidal benthic IBI and low non-tidal instream habitat index, high historic wetland loss (17,867 acres), high soil erodibility (0.30), and being on the 303(d) List for water quality impairment. Indicators of Category 3 include a high tidal fish IBI, high imperiled aquatic species indicator, a migratory fish spawning area, and a high anadromous fish index.

According to the 2002 Maryland Section 305(b) Water Quality Report, portions of the tidal Wye River and tributaries fail to support all designated uses (7.3 $mi.^2$ fail to support; 2.6 $mi.^2$ inconclusive) due to bacteria from nonpoint, failing septic systems, and natural sources. Nontidal wadeable tributaries fully support all designated uses (25.6 mi. support, 12.9 mi. inconclusive). Wye Mills Community Lake fails to support all designated uses (61.5 acres) due to nutrients and low oxygen from nonpoint, upstream, natural, and sediment oxygen demand.

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

- *Wye River* (tidal); fecal coliform, nutrients, suspended sediments.
- *Unnamed tributary to Wye East River* (021305030436 non-tidal); poor biological community.
- *Unnamed tributary to Wye East River* (021305030437 non-tidal); poor biological community.

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MBSS found BIBI and FIBI to be fair to poor.

Restoration/Preservation

This watershed has a fair amount of Green Infrastructure, including a moderate-sized hub in the eastern part. Some of this GI land is protected by State-owned Wye Island NRMA and private conservation (Aspen Institute) but the eastern GI hub is unprotected. According to the Maryland Greenways Commission, proposed and existing greenways include:

- *Queen Anne's County Water Trail*: a proposed water trail along the upper Chester River that would extend around Kent and Wye Islands
- *Wye Island NRMA*: an existing ecological and recreational greenway that includes Wye Island NRMA and Aspen Institute.

There is one State-designated Nontidal Wetland of Special State Concern (WSSC) within the Queen Anne's County portion of this watershed and one potential WSSC.

- *Starr Ponds*. This site contains two small relatively undisturbed Delmarva bays with three State Endangered herbaceous plant species. Delmarva bays are seasonal groundwater fed ponds that provide unique habitat and therefore often rare plant and animal species. Site visits conducted during different seasons may reveal additional rare plant and animal species. These bays were once more common on the Eastern Shore, but many have been destroyed due to drainage and filling for agriculture and development (DNR, 1991). This site is currently unprotected.
- *Potential WSSC*. This site is located east of Lloyds Meadow Lane and Rte. 213. It is unprotected.

The watershed contains several examples of high quality, relatively undisturbed tidal wetlands that serve as reference sites for the vegetative community type dominated by the shrubs *Iva frutescens/Spartina patens* (Marsh elder/Saltmeadow cordgrass). The vegetative community is daily to irregularly flooded by mesohaline waters. Reference sites are located along the Wye River, Wye Narrows, and Wye East River.

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.
- Restore "gaps" in Green Infrastructure back to natural vegetation (including GI corridors).

Specific protection recommendations:

- Protect wetlands and streams within the headwaters.
- Protect areas within the Green Infrastructure that are currently unprotected, especially along waterways.
- Protect the WSSC and surrounding buffers.
- Protect additional wetlands within designated Ecologically Significant Areas.
- Protect wetlands used as reference sites in the DNR study of tidal wetland vegetative communities (along Wye East River and Wye Narrows).

<u>Kent Narrows (02130504)</u>

Background

This watershed has roughly 7,004 land acres (based on MDP 2002 land use GIS data). Land use is divided between agriculture (34%), developed land (28%), forest (26%), and wetland (12%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR.

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

- Estuarine
    - Emergent: 771 acres
    - Scrub shrub: 48 acres
    - Forested: 10 acres
    - Unconsolidated shore: 67 acres
    - Rocky shore: <1 acre
- Palustrine
    - Emergent: 19 acres
    - Scrub shrub: 33 acres
    - Forested: 686 acres
    - Unconsolidated bottom: 40 acres
    - Farmed: 37 acres
- Total: 1,710 acres

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

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130504	-1.28	0.73	0	0	-0.55

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

Water Quality

Source water assessments were conducted for a few water supplies in the watershed. The water supply and susceptibility are as follows:

- *Prospect Bay* (Eastern part of the Bay): arsenic and radionuclides.
- *Oyster Cove* (northern part of the Bay): arsenic.

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. Failing indicators include high percent stream buffer unforested (77%) and being on the 303(d) List for water quality impairment.

According to the 2002 Maryland Section 305(b) Water Quality Report, a small portion of tidal Kent Narrows/Prospect Bay and tributaries fail to support all designated uses (6.9 $mi.^2$ support; 0.4 $mi.^2$ fail to support) due to bacteria from industry, nonpoint, failing septic systems, and natural sources.

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

- *Prospect Bay* (tidal); nutrients, suspended sediments.
- *Wells Cove* (021305040431 tidal); fecal coliform.
- *Little Creek* (021305040429 tidal); fecal coliform.

Restoration/Preservation

There is a large Green Infrastructure hub encompassing Horsehead Wetland Center and the Grasonville area and a GI corridor along Kirwan Creek. There are some large parcels protected through METs or private conservation (Wildlife Trust of North America) along Prospect Bay, but some large GI areas still remain unprotected. According to the Maryland Greenways Commission, proposed and existing greenways include:

- *Queen Anne's County Water Trail*: a proposed water trail along the upper Chester River that would extend around Kent and Wye Islands
- *Kent Narrows Pathways*: an existing trail are the trail connecting Cross Island Trail Park and Cross County Trail.

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

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.
- Restore Green Infrastructure "gaps" in natural vegetation, including within the METs.

Specific protection recommendations:

- Protect wetlands and streams within the headwaters.
- Protect the unprotected portion of the Green Infrastructure hub at Greenwood and Watermans.
- Protect additional wetlands within designated Ecologically Significant Areas.
- Protect wetlands used as reference sites in the DNR study of tidal wetland vegetative communities (along Kirwan Creek and Prospect Bay).

Lower Chester River (02130505)

Background

The Queen Anne's portion of this watershed has approximately 17,895 land acres (based on MDP 2002 land use GIS data). Over half of the land use is agriculture (57%), a quarter is forest (24%), and smaller amounts are developed land (15%) and wetland (5%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR.

There are extensive freshwater tidal marshes located along meandering portions or on alluvial deposits along the Chester River. The Chester River has excellent wintering and transient concentration areas of black ducks. Some of the regions highest densities of transient and wintering waterfowl are located in the Chester River (Sipple, 1999).

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

- Estuarine
    - Emergent: 2,702 acres
    - Scrub shrub: 63 acres
    - Forested: <1 acre
    - Unconsolidated shore: 211 acres
- Palustrine
    - Aquatic bed: 2 acres
    - Emergent: 228 acres
    - Scrub shrub: 195 acres
    - Forested: 3,312 acres
    - Unconsolidated bottom: 487 acres
    - Farmed: 112 acres
- Total: 7,313 acres

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

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130505	-2.87	1.42	0	2.90	1.45

Code of Maryland Regulations

All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. For this watershed, they are designated as follows:

- All estuarine portions except those listed below: Use II, shellfish harvesting.

- Piney Creek (above Rte. 50) and Wincester Creek: Use I recreation contact and protection of aquatic life.

Water Quality

A source water assessment was completed for some water systems in this watershed. The water system and susceptibilities is as follows:

- *Queenstown*: arsenic, VOC.
- *Fox Run Condominiums* (~1 mile southwest of Queenstown): arsenic.
- *Bayview at Kent Narrows*: arsenic.

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. Failing indicators include high nutrient concentrations, low SAV abundance, low SAV habitat index, low tidal fish IBI, high historic wetland loss (27,593 acres), and being on the 303(d) List for water quality impairment. An indicator suggesting need for preservation includes having four migratory fish spawning areas.

According to the 2002 Maryland Section 305(b) Water Quality Report, tidal Lower Chester River and tributaries fail to support all designated uses (64.2 $mi.^2$) due to bacteria, PCBs, dieldrin, low oxygen, and poor benthic community from nonpoint, failing septic systems, eutrophication, and natural sources (e.g. poor tidal flushing).

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

- *Lower Chester River*; poor biological community, fecal coliform, nutrients, suspended sediment, PCBs in fish tissue.
- *Reed Creek* (021305050391 in Queen Anne's County); poor biological community.
- *Swan Creek Unnamed Tributary* (021305050388 in Kent County); poor biological community
- *Queenstown Creek Unnamed Tributary* (021305050390 in Queen Anne's County); poor biological community
- *Grays Inn Creek* (021305050389 in Kent County); poor biological community.
- *Grays Inn Creek Unnamed Tributary* (021305050389 in Kent County); poor biological community.

Restoration/Preservation

This watershed contains a few sections within the Green Infrastructure network including a corridor crossing the Chester River at Bookers Warf, and hub and corridors around Queenstown and north of Queenstown. Some of the GI area between Gordons Point and Break Point are protected through METs. According to the Maryland Greenways Commission, proposed and existing greenways include:

- *Queen Anne's County Water Trail*: a proposed water trail along the upper Chester River that would extend around Kent and Wye Islands
- *Kent Narrows Pathways*: an existing trail are the trail connecting Cross Island Trail Park and Cross County Trail.
- *Cross Island Trail Park*: an existing recreational trail connecting Terrapin Beach Park with Chesapeake Exploration Center and Kent Narrows Pathways
- *Cross County Trail*: a proposed recreational trail connecting Queenstown, Centerville and Tuckahoe State Park

The following information is summarized from the document *Rural Legacy FY 2003: Applications and State Agency Review*. There are two Rural Legacy areas within this County, Chino Farms and Lands End. Chino Farms is in the northwestern portion of the County, and will create a continuous protected area from Rte. 301 to the Chester River. This area is important because it includes endangered species, Delmarva Bays, and areas for migratory birds. The protection goals include preserving agriculture and forest. The sponsor is The Conservation Fund. There are 6,880 acres in this area. They are expected to successfully preserve 91% of this area by late 2003 and hope to expand the area of interest at that point. The second RLA is called Lands End. It is located on the northwestern portion of the County and follows the Chester River and a portion of the Corsica River. The sponsor is Queen Anne's County. There are 3,752 acres in this area, with 44% being protected. The goals include protecting agricultural land and natural resources, including wetland and wildlife habitat, Chester River shoreline, and access to the Corsica River. The report also includes a list of property owners who are interested in selling an easement and the priority of acquiring these easements. Since the Rural Legacy Program funds are not always adequate enough to support all of these requests, other programs should consider preservation of these sites.

The watershed contains examples of high quality, relatively undisturbed tidal wetlands that serve as reference sites for their vegetative community type dominated by the shrubs *Baccharis halmifolia*/*Iva frutescens/Panicum virgatum* (Groundsel tree/Marsh elder/Switch grass). The vegetative community is daily to irregularly flooded by mesohaline waters. The site is located along the Chester River.

There are no State-designated Nontidal Wetlands of Special State Concern within the Queen Anne's portion of this watershed.

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.
- Restore Green Infrastructure "gaps" to natural vegetation.

Specific protection recommendations:

- Protect wetlands and streams within the headwaters.
- Protect Green Infrastructure, especially the portion of remaining unprotected Green Infrastructure hub around Reed Creek and the Green Infrastructure hub around Gouldtown.

- Protect land within designated rural legacy area, starting with highest priority properties.
- Protect additional wetlands within designated Ecologically Significant Areas.
- Protect wetlands used as reference sites in the DNR study of tidal wetland vegetative communities.

Corsica River (02130507)

Background

There are approximately 23,904 land acres (based on MDP 2002 land use GIS data). The dominant land use is agriculture (64%), followed by forest (28%) and developed land (8%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR. This waterway is 6 miles long and is a tributary to the Chester River. The watershed has roughly two-thirds prime farmland and one-fifth hydric soils (Shanks, 2003).

Most of the historic wetland loss occurred in the upper headwater tributaries of Three Bridges and Mill Stream subwatersheds. Many of these areas were converted to productive agricultural land through artificial drainage (ditches and grass swales) (Shanks, 2003).

The bald eagle is the only documented State-designated RTE species in this watershed. There is also a colonial waterbird nesting area. Flooding is a local concern, especially on public road crossings (Shanks, 2003).

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

- Estuarine
    - Emergent: 159 acres
    - Scrub shrub: 6 acres
    - Unconsolidated shore: 17 acres
- Palustrine
    - Emergent: 101 acres
    - Scrub shrub: 54 acres
    - Forested: 2,104 acres
    - Unconsolidated bottom: 96 acres
    - Farmed: 56 acres
- Total: 2,593 acres

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

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130507	-1.04	0.45	0	0	-0.58

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. For this watershed, they are designated as follows:

- All estuarine portions except those listed below: Use II, shellfish harvesting.
- Corsica River (above Earl Cove): Use I, recreation contact and protection of aquatic life.

Water Quality

Based on the source water assessment, it was determined that the water supply for Centerville is susceptible to contamination by arsenic and radionuclides. The community water supply draws from the groundwater, generally the confined aquifer.

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. Since it is a "Priority" Category 1 watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. Failing indicators include high modeled phosphorus loading, low SAV abundance, low SAV habitat index, low non-tidal benthic IBI, low non-tidal instream habitat index, high soil erodibility (0.32), and being on the 303(d) List for water quality impairment. One indicator suggesting need for preservation includes two migratory fish spawning areas.

According to the 2002 Maryland Section 305(b) Water Quality Report, tidal Corsica River and tributaries fail to support all designated uses (2.1 $mi.^2$) due to PCBs and dieldrin from an unknown source. Nontidal wadeable tributaries (e.g. Gravel Run subwatershed; DNR, 2000) fail to fully support all uses (24.9 mi. fail to support, 8.8 mi. inconclusive) due to a poor benthic community from municipal discharge, agricultural runoff, changes in habitat and hydrology, and channelization.

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

- *Corsica River* (tidal); fecal coliform, suspended sediments, PCBs in fish tissue. A TMDL has been completed for nutrients.
- *Gravel Run* (021305070397 non-tidal); poor biological community.
- *Three Bridges Branch Unnamed Tributary* (021305070397 non-tidal); poor biological community.
- *Mill Stream Branch* (021305070396 non-tidal); poor biological community.

- *Mill Stream Branch Unnamed Tributary* (021305070396 non-tidal); poor biological community.

The following information is summarized from the 2000 MDE document entitled *Total Maximum Daily Loads of Nitrogen and Phosphorus for the Corsica River*. The estuarine section below Earl Cove is Use II and the free-flowing tributaries are Use I. Eutrophication caused by high nutrients, has caused algal blooms and dissolved oxygen <5.0ug/l. Sources of these elevated nutrients include: nitrogen – mainly agriculture (86%), followed by forest (6%), urban (4%), and point sources (4%); phosphorus – mainly agriculture (84%), followed by point sources (11%), urban (3%) and forest (2%). The main point source is Centerville WWTP. Based on water samples, water quality is impaired in the upper reaches. Highest levels of chlorophyll a were found in the upstream portion (with maximum values at Watson Road Bridge 146 ug/l). Inorganic phosphorus, total nitrogen, and dissolved oxygen were also the worst in the upstream sections. The Centerville WWTP likely contributes to local degradation in water quality. However, since point sources are thought to be responsible for only a small amount of the total nitrogen and phosphorus in the Corsica River (4% and 11% respectively), nonpoint sources need to be addressed as well.

A Draft TMDL was completed for fecal coliform in the restricted shellfish harvesting area of the Corsica River (MDE, 2005b). A permitted point source discharging into this basin is a municipal WWTP in Centerville, discharging into Gravel Run. Nonpoint sources are estimated as follows:

Basin	Livestock %	Pets %	Humans %	Wildlife %
Corsica River Basin	57	6	1	37

A WRAS was completed for the Corsica River watershed in 2003 and 2004. The following information is based on the 2003 DNR document entitled *Corsica River Watershed Characterization*.

The Corsica River, Emory Creek, Three Bridges Branch, and Mill Stream Branch contain anadromous fish spawning areas (white perch, herring, yellow perch). Although most of the nontidal fish species found in this watershed are fairly tolerant of poor water quality, there are two species present in the headwaters of Mill Stream Branch and Three Bridges Branch that indicate good conditions (roseyside dace and least brook lamprey). Recent aerial photography reveals that SAV are limited to small patches near the Chester River confluence, including Middle Quarter Cover, River Estates area, and Town Point. Oyster beds are no longer present in the Corsica River. This may be partially due to high sedimentation. Although the Centerville WWTP contributes a high amount of point source nutrients, this may be significantly reduced in 2004 due to plans to apply the treated sewage to the land.

MBSS sampled several sites in this watershed in 1995 and 2000 and Stream Waders sampled sites in 2000. All MBSS fish sampling sites were ranked fair or good. The Mill Stream Branch subwatershed had seven samples with benthic IBI scores of poor to good,

Three Bridges Branch Gravel Run subwatershed had eight samples ranging from poor to good, Corsica direct drainage had five samples ranging from very poor to good. For the MBSS physical habitat assessment, the samples along Mill Stream Branch and Three Bridges Branch were ranked as fair or good while Gravel Run was ranked as poor. In addition to the MBSS and Stream Waders data for the Corsica watershed, DNR monitored two sites using the rapid bio-assessment. Old Mill Stream (at Taylors Mill Road) had good benthic, good habitat, and fair/good water quality while Three Bridges Branch (at Route 213) had poor/fair benthic, poor/fair habitat, and fair/good water quality. Both sites had good or excellent riparian buffer but heavy sediment load.

DNR conducted a nutrient synoptic survey for the Corsica River in April 2003. Four samples (Unnamed tributary to Mill Stream Branch at the confluence, Mill Stream Branch at Route 304, Three Bridges Branch, and Unnamed tributary to Three Bridges Branch at Tanyard Road) had excessive nitrate/nitrite concentrations. The source of the first two may be intensive row crops. The source of the latter two was less clear and may have been related to septic systems and extensive wetlands releasing nitrogen before leaf-out. Nitrate/nitrite yields were excessive at many sites. For samples within Mill Stream Branch, this may have largely been due to agriculture. In Three Bridges Branch, these high yields may have been caused by septic systems and agriculture. Many samples had high or excessive orthophosphate levels, likely due to the high amount of sediment in the water column, since it was a wet spring during most of the sampling period. One sample had a pH of 5.96, possibly caused from local dredge spoil. Dissolved oxygen was generally good, with the exception of an unnamed tributary to Mill Stream Branch at Route 304 with DO < 5mg/L. Biological sampling found generally poor habitat quality, and in some cases this was more limiting that the water quality. Streams had strong storm water impacts and could dry up even during moderate low flow periods. Route 301, other roads, parking lots, and developed areas may be contributing large amounts of storm water and sediment to the system.

Restoration/Preservation

In September 2005, Maryland Governor Robert L. Ehrlich, Jr. announced that the Corsica River watershed will be used as a pilot project to show that by focusing resources, an entire watershed can be restored.

A Stream Corridor Assessment was completed for the entire Corsica River watershed in 2004 (Czwartacki et al., 2004). This included surveying 45 stream miles and 25 shoreline miles. During the stream portion of the survey, they identified 247 potential problems in the stream survey, with the most frequent including: erosion (57 sites, 12.2 miles, with 20 sites being rated severe or very severe), pipe outfalls (56 sites, with four sites being rated severe or very severe), fish barriers (53 sites, with one site rated severe), inadequate buffer (34 sites, 4 miles, with 10 sites being rated severe or very severe), altered shoreline (24 sites), and channel alteration (20 sites, 1.2 miles). During the shoreline portion of the survey, they identified 49 problems with the most frequent including: altered shorelines (24 sites, 10% or 2.5 miles, with two sites rated severe or very severe), inadequate buffer

(18 sites, 19% or 4.7 miles, six sites rated severe or very severe), and excessive shoreline erosion (7 sites, 3% or 0.7 miles, with one site rated severe).

This watershed contains some Green Infrastructure, unprotected, including hubs in the headwaters of Emory Creek and east of Centerville and corridors around Centerville. There are some large METs and County-owned land outside of the GI network. The Maryland Greenways Commission proposed Cross County Trail connecting Queenstown, Centerville and Tuckahoe State Park.

A pilot effort to restore the Corsica River watershed began in 2005. A variety of best management practices and wetland creation/restoration projects are planned.

The following information is summarized from the document *Rural Legacy FY 2003: Applications and State Agency Review*. There are two Rural Legacy areas within this County, Chino Farms and Lands End. Chino Farms is in the northwestern portion of the County, and will create a continuous protected area from Rte. 301 to the Chester River. This area is important because it includes endangered species, Delmarva Bays, and areas for migratory birds. The protection goals include preserving agriculture and forest. The sponsor is The Conservation Fund. There are 6,880 acres in this area. They are expected to successfully preserve 91% of this area by late 2003 and hope to expand the area of interest at that point. The second RLA is called Lands End. It is located on the northwestern portion of the County and follows the Chester River and a portion of the Corsica River. The sponsor is Queen Anne's County. There are 3,752 acres in this area, with 44% being protected. The goals include protecting agricultural land and natural resources, including wetland and wildlife habitat, Chester River shoreline, and access to the Corsica River. The report also includes a list of property owners who are interested in selling an easement and the priority of acquiring these easements. Since the Rural Legacy Program funds are not always adequate enough to support all of these requests, other programs should consider preservation of these sites.

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

The Corsica WRAS developed strategies to improve water quality and habitat within the watershed, with relevant ones including:

- Reestablishing submerged aquatic vegetation.
- Creating non-agricultural wetlands. They will seek two wetland restoration sites (totally about 1 acre) on public land to encourage environmental education and improve water quality.
- Oyster reef establishment.

The *Corsica River Watershed Characterization* identified general areas for restoration. These included:

- Headwater stream buffers.
- Areas receiving pollution from crop or pasture fields.
- Hydric soils.

- Close proximity to existing wetlands or streams.

Existing Restoration Recommendations:

- Restore wetlands and streams within the headwaters.
- Where high historic wetland loss occurred: Upper headwater tributaries of Three Bridges and Mill Stream subwatersheds. Restoration of these areas, largely artificially drained agricultural land and low-density residential, may be desirable where there is landowner interest (Shanks, 2003).
- Wetland restoration may also be possible in the downstream urban areas, at or near the tidal interface with the Corsica River. These tidal and nontidal areas are in public land within Centerville municipal limits (Shanks, 2003).
- A wetland restoration project may also be possible in the Town of Centerville-owned 70 acre old mill pond, east of Maryland Rte. 213 (Shanks, 2003).
- Another possible Town-owned site is an existing pond in Gravel Run, located immediately upstream of MD Rte. 213 (Shanks, 2003).
- Erosion and habitat loss along the tidal Corsica River can be remedied through Living Shorelines (Shanks, 2003).
- Erosion on very severe SCA sites: Emory Creek, on the south fork of Three Bridges Branch, and on the headwaters of Gravel Run, below a railroad crossing (Czwartacki et al., 2004).
- Inadequate buffers found on SCA sites: on the headwaters of Three Bridges Branch and on the headwaters of Mill Stream Branch (Czwartacki et al., 2004).
- Altered shorelines found in the SCA sites: near the mouth of Corsica River and consists of about 2,500 feet of concrete below a crop field (Czwartacki et al., 2004).
- Inadequate buffer found in the SCA sites: a crop field on the north shore at the mouth of the Corsica River, a residential community on the south shore at Middle Quarter Cove, and a sparsely vegetated site on the western shore of the tidal Mill Stream Branch (Czwartacki et al., 2004).
- Restore areas within the Green Infrastructure hub, currently in agriculture, to natural vegetation (including along waterways and GI corridors).
- Restore wetlands in the Corsica River watershed, designed to remove/cycle nitrogen, phosphorus, and fecal coliform before it enters the Corsica River.
- Reestablish submerged aquatic vegetation.
- Create non-agricultural wetlands to encourage environmental education and improve water quality.
- Establish oyster reefs.

Specific protection recommendations:

- Protect wetlands and streams within the headwaters.
- Protect land within designated rural legacy area, starting with highest priority properties.
- Protect land within the Green Infrastructure, especially along waterways.
- Protect wetlands that function to remove nitrogen and phosphorus from the waterways.

- Protect additional wetlands within designated Ecologically Significant Areas.

Southeast Creek (02130508)

Background

This watershed has roughly 34,740 land acres (based on MDP 2002 land use GIS data). This land use is dominated by agriculture (69%), with smaller amounts of forest (27%), developed land (3%) and wetlands (1%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR.

Southeast Creek flows into the Chester River and is roughly 5 miles long (from the Chester River confluence to the headwaters; MDE, 2003).

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

- Estuarine
  - Emergent: 328 acres
  - Forested: <1 acre
  - Unconsolidated shore: 20 acres
- Palustrine
  - Emergent: 146 acres
  - Scrub shrub: 86 acres
  - Forested: 3,254 acres
  - Unconsolidated bottom: 220 acres
  - Farmed: 164 acres
- Total: 4,218 acres

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

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130508	-0.59	0.23	0	1.40	1.03

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

Water Quality

Based on a source water assessment, the water supply for the Eastern Pre-Release Unit (south of Church Hill) is susceptible to contamination from arsenic.

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. It is also classified as a Category 3, a watershed in need of protection. Failing indicators include low SAV abundance, low SAV habitat index, low non-tidal benthic IBI, low non-tidal instream habitat index, high soil erodibility (0.31), and being on the 303(d) List for water quality impairment. Indicators for Category 3 include a high imperiled aquatic species indicator and four migratory fish spawning areas.

According to the 2002 Maryland Section 305(b) Water Quality Report, tidal Southeast Creek and tributaries fail to support all designated uses (0.9 $mi.^2$ fail to support, 16.0 $mi.^2$ inconclusive) due to bacteria from nonpoint sources. A portion of the nontidal wadeable tributaries (e.g. Island Creek subwatershed[2000]) fail to fully support all uses (4.6 mi. support, 18.6 mi. fail to support, 13.7 mi. inconclusive) due to a poor biological community from siltation, low oxygen, changes in habitat and hydrology, septic systems, and channelization.

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

- *Southeast Creek* (tidal); fecal coliform, suspended sediments. A TMDL has been completed for nutrients.
- *Island Creek* (021305080398 non-tidal); sedimentation, poor biological community.
- *Unnamed tributary to Island Creek* (021305080398 non-tidal); poor biological community.

The following information is summarized from the 2003 MDE document entitled *Total Maximum Daily Loads of Phosphorus for Southeast Creek, Queen Anne's County, Maryland*. This waterway is designated Use 1. Water quality does not support this designation due to high chlorophyll a, some locations with dissolved oxygen <5.0mg/l, and other areas where DO is likely <5.0mg/l at night. Sources of nutrients are as follows: nitrogen – agriculture (93%), urban (3%), point sources (<1%), atmospheric (<1%), forest/herbaceous (3%); phosphorus – agriculture (94%), urban (2%), point sources 3%), atmospheric (<1 %), and forest/herbaceous (<1%). Main point sources are Church Hill WWTP and Eastern Pre-Release Unit WWTP. Water samples during the low flow period show that chlorophyll a is occasionally >50ug/l and DO is occasionally below 5.0mg/l. Highest dissolved inorganic nitrogen is found at two nontidal stations. TMDLs require a 19% reduction in low flow nonpoint source phosphorus and 61% reduction in average annual controllable nonpoint source phosphorus.

MBSS found FIBI was generally fair, while BIBI was more variable, ranging from good to very poor.

Restoration/Preservation

This watershed has Green Infrastructure hubs and corridors spread throughout, including along some of the waterways of Island Creek, Granny Finley Branch, Southeast Creek, and Brown's Branch. A portion of the hub along Island Creek is protected by a MET, but the remaining GI land is unprotected. Some GI "gaps," especially along waterways, may provide ideal locations for restoration to natural vegetation.

The following information is summarized from the document entitled *Rural Legacy FY 2003: Applications and State Agency Review*. There are two Rural Legacy areas within this County, Chino Farms and Lands End. Chino Farms is in the northwestern portion of the County, and will create a continuous protected area from Rte. 301 to the Chester River. This area is important because it includes endangered species, Delmarva Bays, and areas for migratory birds. The protection goals include preserving agriculture and forest. The sponsor is The Conservation Fund. There are 6,880 acres in this area. They are expected to successfully preserve 91% of this area by late 2003 and hope to expand the area of interest at that point. The second RLA is called Lands End. It is located on the northwestern portion of the County and follows the Chester River and a portion of the Corsica River. The sponsor is Queen Anne's County. There are 3,752 acres in this area, with 44% being protected. The goals include protecting agricultural land and natural resources, including wetland and wildlife habitat, Chester River shoreline, and access to the Corsica River. The report also includes a list of property owners who are interested in selling an easement and the priority of acquiring these easements. Since the Rural Legacy Program funds are not always adequate enough to support all of these requests, other programs should consider preservation of these sites.

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

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.
- Restore areas within the Green Infrastructure hub, currently in agriculture, to natural vegetation (especially along waterways and within large hubs).
- Restore wetlands designed to remove phosphorus from the waterways before it enters Southeast Creek.

Specific protection recommendations:

- Protect wetlands and streams within the headwaters.
- Protect land within designated rural legacy area, starting with highest priority properties.
- Protect wetlands that function to remove phosphorus from the waterway.
- Protect currently unprotected Green Infrastructure, especially around waterways.
- Protect additional wetlands within designated Ecologically Significant Areas.

<u>Middle Chester River (02130509)</u>

Background

The Queen Anne's County portion of this watershed has roughly 7,882 land acres (based on MDP 2002 land use GIS data). Land use is dominated by agriculture (78%), with smaller amounts of developed land (11%), forest (11%), and wetland (1%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR.

There are extensive freshwater tidal marshes located along meandering portions or on alluvial deposits along the Chester River. The Chester River has excellent wintering and transient concentration areas of black ducks. Some of the regions highest densities of transient and wintering waterfowl are located in the Chester River (Sipple, 1999).

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

- Estuarine
    - Emergent: 608 acres
    - Scrub shrub: 8 acres
    - Unconsolidated shore: 25 acres
- Palustrine
    - Aquatic bed: 6 acres
    - Emergent: 189 acres
    - Scrub shrub: 160 acres
    - Forested: 677 acres
    - Unconsolidated bottom: 393 acres
    - Unconsolidated shore: 2 acres
    - Farmed: 18 acres
- Total: 2,085 acres

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

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130509	-0.62	0	0	8.69	8.07

Code of Maryland Regulations

All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. For this watershed, they are designated as follows:

- Chester River and tributaries (above Rte. 213): Use I recreation contact and protection of aquatic life.
- All estuarine portions except those listed above: Use II, shellfish harvesting.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. Since it is a "Priority" Category 1 watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. It is also classified as a Category 3, a pristine or sensitive watershed in need of protection. Failing indicators include a high modeled nitrogen loading, poor SAV abundance, poor SAV habitat index, low non-tidal benthic IBI, high soil erodibility (0.30), and being on the 303(d) List for water quality impairment. Indications for Category 3 include a high imperiled aquatic species indicator, five migratory fish spawning areas, and a high number of wetland-dependent species.

According to the 2002 Maryland Section 305(b) Water Quality Report, the tidal Middle Chester River and tidal tributaries fail to support all designated uses due to dieldrin, PCBs, and bacteria from unknown and nonpoint sources. A portion of the nontidal wadeable tributaries (Morgan Creek; DNR, 2000) also did not support all designated uses (19.7 miles fail to support, 28.5 miles were inconclusive) due to a poor benthic community from agricultural runoff and changes in habitat and hydrology (e.g. channelization and unstable stream banks; DNR, 2000). Urieville Community Lake (35.0 acres) also failed to support all designated uses due to nutrients, low DO, excess vegetation, and siltation. These may be the results of agricultural runoff, SOD, and upstream and nonpoint sources.

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

- *Middle Chester River* (tidal); fecal coliform, PCBs in fish tissue, sediments, nutrients.
- *Urieville Lake* (in Kent County); A TMDL has been completed for nutrients and suspended sediments.
- *Morgan Creek Unnamed Tributary* (021305090414 non-tidal in Kent County); poor biological community.
- *Morgan Creek* (021305090415 non-tidal in Kent County); poor biological community.
- *Morgan Creek Unnamed Tributary* (021305090415 non-tidal tidal in Kent County); poor biological community.
- *Chester River Unnamed Tributary* (021305090412 non-tidal in Queen Anne's County); poor biological community.

Restoration/Preservation

There is very little Green Infrastructure within this watershed, mainly just sections of unprotected corridor near Kingston. The Kent County side of the Chester River has a

designated GI corridor. The Maryland Greenways Commission proposed a water trail extending from the upper Chester River around Kent and Wye Islands.

The following information is summarized from the document *Rural Legacy FY 2003: Applications and State Agency Review*. There are two Rural Legacy areas within this County, Chino Farms and Lands End. Chino Farms is in the northwestern portion of the County, and will create a continuous protected area from Rte. 301 to the Chester River. This area is important because it includes endangered species, Delmarva Bays, and areas for migratory birds. The protection goals include preserving agriculture and forest. The sponsor is The Conservation Fund. There are 6,880 acres in this area. They are expected to successfully preserve 91% of this area by late 2003 and hope to expand the area of interest at that point. The second RLA is called Lands End. It is located on the northwestern portion of the County and follows the Chester River and a portion of the Corsica River. The sponsor is Queen Anne's County. There are 3,752 acres in this area, with 44% being protected. The goals include protecting agricultural land and natural resources, including wetland and wildlife habitat, Chester River shoreline, and access to the Corsica River. The report also includes a list of property owners who are interested in selling an easement and the priority of acquiring these easements. Since the Rural Legacy Program funds are not always adequate enough to support all of these requests, other programs should consider preservation of these sites.

The Kent County (Morgan Creek) portion of this watershed contains a reference site for high quality *Salix nigra* (Black willow) tidal wetland community. This wetland is subject to daily freshwater tidal inundation. This is an uncommon vegetative community type (Harrison and Stango, 2003).

There are no State-designated Nontidal Wetlands of Special State Concern (WSSC) within the Queen Anne's portion of this watershed. However, there is a potential WSSC located near Ewingtown that is currently unprotected.

Specific restoration recommendations:

- Restore wetlands and streams within the headwaters.
- Restore areas within the Green Infrastructure hub, currently in agriculture, to natural vegetation (especially around the Chester River and tributaries).

Specific protection recommendations:

- Protect wetlands and streams within the headwaters.
- Protect land within designated rural legacy area, starting with highest priority properties.
- Protect land within the Green Infrastructure, especially around the Chester River and other waterways.
- Protect additional wetlands within designated Ecologically Significant Areas.

<u>Upper Chester River (02130510)</u>

Background

The Queen Anne's portion of this watershed has roughly 51,837 land acres (based on MDP 2002 land use GIS data). Land use is dominated by agriculture (62%), followed by forest (33%) and developed land (4%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR.

Based on MDP's Natural Soil Groups, over half of the soils is prime farmland. Roughly a third of the soil is hydric (Shanks, 2005).

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

- Estuarine
  - Emergent: 407 acres
  - Unconsolidated shore: <1 acres
- Palustrine
  - Emergent: 488 acres
  - Scrub shrub: 281 acres
  - Forested: 11,319 acres
  - Unconsolidated bottom: 475 acres
  - Unconsolidated shore: <1 acres
  - Farmed: 477 acres
- Total: 13,448 acres

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

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130510	-1.80	0.19	5.70	7.14	11.23

Numerous acres of Delmarva Bays and other Nontidal Wetlands of Special State Concern are managed for invasive species control as a programmatic mitigation project in this watershed. Sites were initially treated in 2002 and 2003 and monitoring will continue for five years.

This watershed contains brown trout (a rare occurrence on the Eastern Shore) and headwater forested wetland. Wetlands connected to the Upper Chester River and its tributaries include estuarine vegetated wetlands, mudflats, freshwater tidal wetlands, forested wetlands flooded occasionally by spring tides, and nontidal wetlands. Most nontidal wetlands are associated with streams and floodplains. There are also a high number of nontidal wetlands known as Delmarva Bays, or Carolina Bays on the Delmarva. These wetlands are small depressions of up to nearly 20 acres in size, with a round, elliptical or irregular shape and many are surrounded by a sandy raised rim. While

the topography of the watershed is generally level, nontidal wetlands, associated streams and floodplains are usually found in ravines of varying depths. Soils are often acidic, and become more so when drained.

Tidal Wetlands

Tidal wetlands in the entire Chester River watershed total approximately 16,204 acres (McCormick and Somes, 1982), comprising 6.2% of the State's total tidal wetland acreage and ranking sixth among major basins with tidal areas. High brackish marshes are the most common type, dominated by meadow cordgrass and spike rush or shrubby marshelder and groundsel bush. This latter type of community is important habitat for birds, which often nest in the shrubs and feed in the herbaceous marshes. Freshwater (palustrine) wetlands typically have more diverse vegetation than the estuarine marshes, in which diversity is limited to a few species of salt tolerant plants. The three dominant vegetation communities in the freshwater tidal marshes of the Upper Chester are pickerelweed/arrowarum, cattail, and big cordgrass. In the higher freshwater reaches, there are also some areas of tidally influenced red maple forest. Tidal wetlands have deep organic soils, which aid in chemical interactions for nutrient transformation.

Tidal wetlands and the Chester River floodplain generally become more narrow and limited in extent in upstream areas. There is a large oxbow that appears to be forming west of Millington with more extensive tidal wetlands. A railroad bridge and embankment and parts of Millington have suffered from flood impacts in the past. The area may be susceptible to additional to flooding problems due to its location near the tidal/nontidal boundary. High tides will back up water flowing downstream from the headwaters and nontidal tributaries, resulting in higher flood peaks. East of Millington, the floodplain and wetland systems along Cypress Branch and Andover Branch are wider than the freshwater tidal reaches due to lower elevations. A Mill Pond is on Cypress Branch.

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

Water Quality

Based on the source water assessment, the water supply for Pine Springs is susceptible to radionuclides.

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. It is also classified as a Category 3, a pristine or sensitive watershed in need of protection. Failing indicators include high monitored nutrient concentrations, low SAV abundance, low SAV habitat index, high historic wetland loss (36,993 acres), high soil erodibility (0.30), and being on the 303(d) List for water quality impairment. Indicators

of Category 3 include a high imperiled aquatic species indicator and five migratory fish spawning areas.

According to the 2002 Maryland Section 305(b) Water Quality Report, the tidal Upper Chester River and tidal tributaries fully support all designated uses. A portion of the nontidal wadeable tributaries (Anover Branch [2000]) do not fully support all designated uses (60.8 mi. support, 17.5 mi. fail to support) due to poor benthic community resulting from siltation, low dissolved oxygen, changes in habitat and changes in hydrology. Unicorn Mill Pond (48.0 acres) fully supports all designated uses.

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

- *Upper Chester River*; fecal coliform, nutrients, suspended sediments.
- *Anover Branch* (021305100425 in Queen Anne's County); sedimentation.
- *Millington Wildlife Ponds*; methylmercury in fish tissue
- *Unnamed tributary to Unicorn Branch* (021305100422 in Queen Anne's County); poor biological community.

MBSS found BIBI was generally good or fair, with sites ranked poor to very poor being confined to the southeast portion. FIBI was also generally ranked fair or good.

The Chester River Association found that citizens were concerned about algae blooms, siltation and fish kills, failing septics, pipe outfalls, and insufficient stormwater management (Upper Chester River WRAS proposal).

The Chester River mainstem has some eutrophication. DO levels below 5.0 mg/l may occur in warm months (e.g. Foreman Branch). Total nitrogen was elevated and total phosphorus was slightly elevated. Upstream mainstem areas had average chlorophyll a levels greater than 50 mg/l, with some concentrations greater than 100 mg/l. For nontidal streams, based on samples from five streams, Andover Branch had the highest levels of phosphorus, highest BOD, densest algae bloom, and the lowest DO. Red Lion Branch and Unicorn Branch had the highest average total nitrogen, but total nitrogen was also elevated at Cyprus Branch and Andover Branch. There are four permitted point discharges: the wastewater treatment plants for Millington and Sudlerville, Red Bird Egg Farm, and SHA's Millington Shop. contributing point source pollution. Nontidal stream tributaries in Delaware are contributing to the water quality problems in Maryland. (WRAS char).

A nutrient synoptic survey was completed in 2004 for the Kent and Queen Anne's portions of the Upper Chester River watershed. Of the 82 subwatersheds sampled, nitrite/nitrate concentrations were excessive in 28, high in 13, and moderately elevated in 26. Most of the elevated concentrations were associated with animal and row crop agriculture in Red Lion Branch, Unicorn Branch, and Chesterville Branch watersheds. Elevated levels in Forman Branch are likely associated with septic systems. Of the 82 subwatersheds sampled, orthophosphate concentrations were excessive in 8, high in 13,

and moderately excessive in 27 subwatersheds. Excessive levels are associated with suspended phosphorus-rich sediment in the water column along Red Lion and Andover Branches. Forman, Red Lion, Unicorn, and Chesterville Branches contribute large amounts of nutrients to the Chester River. Nutrient concentrations for this watershed are similar to those from other watersheds. Past macroinvertebrate sampling found best populations in Foreman Branch, Unicorn Branch, and Red Lion Branch. While these subwatersheds had high nutrient concentrations, they also had good habitat scores. The well-drained soils of this watershed promote the movement of nutrients into the groundwater and then the Chester River.

Restoration/Preservation

There are several documented anadromous fish spawning areas including the Chester River mainstem to just upstream of Millington, Red Lion Branch, Unicorn Branch, Andover Branch, Mills Branch, an unnamed tributary east of Millington, and an unnamed tributary near Chase Island. For many of these waterways, impoundments have created fish blockages for anadromous fish spawning. Some of these identified blockages include: Cypress Branch / Big Mill Pond, Little Mill Pond, Anover Branch / Jones Lake, unnamed tributary east of Millington / near Peacock Corner, Unicorn Branch / Unicorn Mill Pond, Red Lion Branch / near Rte. 301, Pearl Creek / near Rte. 544. There is a fish consumption advisory due to PCBs, pesticides, and /or methylmercury for channel catfish and white perch from the Chester River, large and smallmouth bass from any waterbody, and bluegill from the impoundments. MBSS sampling rated most sites as good or fair, with some ranked as poor or very poor. There are 6 animal and 28 plant species tracked as sensitive species and 22 ecologically significant areas. The largemouth bass population in the Chester River has declined in the years 2002-2004 (Shanks, 2005).

Of the 220 stream miles, 67% of the stream buffers were naturally vegetated, 32% of the stream buffers lacked natural vegetation and were in agriculture or barren land use, and <1 of the stream buffers were developed. Of the areas lacking natural stream buffers, many had areas of hydric soils (Shanks, 2005). A stream corridor assessment was completed for the Kent and Queen Anne Counties portions of the Upper Chester River in 2005 (Gregory et al., 2005). Of the 75 stream miles surveyed, 224 potential environmental problems were identified. Problems included inadequate stream buffers (82 sites), fish barriers (41 sites), stream bank erosion (37 sites), pipe outfalls (28 sites), channel alteration (18 sites), trash dumping (9 sites), unusual conditions (7 sites), in/near stream construction (1 site), exposed pipe (1 site). While more sites were sampled along Red Lion Branch, nearly half of the identified problem sites were located on this waterway. For the inadequate buffers, the most common land use along the stream was agriculture. Livestock were at three of these sites.

This watershed has a number of Green Infrastructure hub areas. Most of this GI is along the Delaware border (east of Sudlersville) but there is also a moderately sized one just west Sudlersville. Most of this GI land is unprotected. There are some “gaps“ within this GI network currently in agriculture that may be restored to natural vegetation. The

Maryland Greenways Commission proposed a water trail along the upper Chester River that would extend around Kent and Wye Islands.

The following information is summarized from the document *Rural Legacy FY 2003: Applications and State Agency Review*. There are two Rural Legacy areas within this County, Chino Farms and Lands End. Chino Farms is in the northwestern portion of the County, and will create a continuous protected area from Rte. 301 to the Chester River. This area is important because it includes endangered species, Delmarva Bays, and areas for migratory birds. The protection goals include preserving agriculture and forest. The sponsor is The Conservation Fund. There are 6,880 acres in this area. They are expected to successfully preserve 91% of this area by late 2003 and hope to expand the area of interest at that point. The second RLA is called Lands End. It is located on the northwestern portion of the County and follows the Chester River and a portion of the Corsica River. The sponsor is Queen Anne's County. There are 3,752 acres in this area, with 44% being protected. The goals include protecting agricultural land and natural resources, including wetland and wildlife habitat, Chester River shoreline, and access to the Corsica River. The report also includes a list of property owners who are interested in selling an easement and the priority of acquiring these easements. Since the Rural Legacy Program funds are not always adequate enough to support all of these requests, other programs should consider preservation of these sites.

A Watershed Restoration Action Strategy is currently being conducted for this watershed.

There are numerous designated Nontidal Wetlands of Special State Concern in the watershed in both Kent and Queen Anne's Counties. There are three additional sites that are potential WSSC. These may also support rare species or unusual community types and qualify for future designation. Queen Anne's County sites include:

- *Andover Flatwoods*. This site contains several Delmarva bays dominated by herbaceous vegetation. They have five State Endangered plant species, one being a candidate for Federal Listing. Delmarva bays are seasonal groundwater fed ponds that provide unique habitat and therefore often rare plant and animal species. These bays were once more common on the Eastern Shore, but many have been destroyed due to drainage and filling for agriculture and development. Since the species present in this system vary by season, a survey conducted in the spring may identify rare amphibian species (DNR, 1991). The ecological significance of the site is threatened by encroachment of woody vegetation resulting from ditches in the wetland that drain surface water, and drainage from a channelized section of nearby Andover Creek. (Tyndall, 2004 pers. Comm..) This site is unprotected.
- *Cleaves Fork*. This site contains a Delmarva bay with a State Endangered amphibian species. This amphibian uses the pool during the wettest period, in the winter and spring, for breeding. Delmarva bays are seasonal groundwater fed ponds that provide unique habitat and therefore often rare plant and animal species. These bays were once more common on the Eastern Shore, but many have been destroyed due to drainage and filling for agriculture and development. Surveys later in the season may reveal the presence of rare herbaceous plant species that colonize during the drawdown (DNR, 1991). This site is unprotected.

- *Prices Chapel Pond*. This site includes three seasonal ponds dominated by emergent vegetation, with one undisturbed by logging. The undisturbed pond contains a State Endangered plant species, also being a candidate for listing under the U.S. Endangered Species Act. This undisturbed pond is surrounded by a forested buffer. Seasonal ponds are groundwater fed. They provide unique habitat and therefore often rare plant and animal species. These ponds were once more common on the Eastern Shore, but many have been destroyed due to drainage and filling for agriculture and development (DNR, 1991). This site is unprotected.
- *Pristine Pines*. This 2-acre Delmarva bay is dominated by herbaceous species, with a few woody trees. There are three State Endangered plant species (one being nationally rare), one State Threatened plant species, one State Rare plant species, and an amphibian "In Need of Conservation." Delmarva bays are seasonal groundwater fed ponds that provide unique habitat and therefore often rare plant and animal species. These bays were once more common on the Eastern Shore, but many have been destroyed due to drainage and filling for agriculture and development. This entire site is owned by a private conservation organization (DNR, 1991). This site is unprotected.
- *Pristine Pines South (DNR combined with Pristine Pines)*. This site contains a seasonal pond with an amphibian listed as being "In Need of Conservation." Seasonal ponds are groundwater fed. They provide unique habitat and therefore often rare plant and animal species. These ponds were once more common on the Eastern Shore, but many have been destroyed due to drainage and filling for agriculture and development (DNR, 1991). This site is unprotected.
- *Teats Branch Pond (DNR combined with Pristine Pines)*. This site contains a large seasonal pond dominated by shrub and herbaceous species A State Endangered and an uncommon grass species, adapted to the flooding and drought conditions caused by fluctuating water levels, are found at the site. Surveys conducted during different seasons may reveal additional RTE species. Seasonal ponds are groundwater fed. They provide unique habitat and therefore often rare plant and animal species. These bays were once more common on the Eastern Shore, but many have been destroyed due to drainage and filling for agriculture and development. This pond is surrounded by hardwood forest, agricultural fields (to the north and south), and the wetland of special State concern Pristine Pines Preserve owned by The Nature Conservancy (to the east). The main threat to this pond is alteration of hydrology through ditching, drainage, or development of surrounding land (DNR, 1991). This site is unprotected. The surrounding forested buffer should also be protected.
- *Templeville Ponds*. This site includes two Delmarva bays dominated by herbaceous vegetation and surrounded by a large forest. Seasonal ponds are groundwater fed. They provide unique habitat and therefore often rare plant and animal species. These bays were once more common on the Eastern Shore, but many have been destroyed due to drainage and filling for agriculture and development. This site contains a State Endangered (a candidate for listing under the U.S. Endangered Species Act) and an uncommon plant species. Surveys conducted during different seasons may reveal additional RTE species (DNR, 1991). This site is unprotected.
- *Unicorn Millpond*. This site was created by an impoundment on Unicorn Branch (a tributary of the Chester River) and includes a lake and associated wetlands. The

Unicorn Lake portion of the complex mimics the rare type of freshwater system once created by beavers, which were rare in this region as of the early 1990's. It supports two State Endangered submerged plant species, one State Highly Rare submerged plant species, and three uncommon plant species. The lake also provides exceptional habitat for resident and migratory songbirds, waterfowl, and wading birds, as well as fish, reptiles and amphibians (DNR, 1991). There is little buffer around the pond, so there is high potential for siltation into the pond. With that said, the main threat is water pollution from the surrounding land. A surrounding buffer should be acquired and returned to forest. Only a small portion of this site is within Unicorn Lake FMA.

- *Potential WSSC* (all unprotected). These include a wetland complex near Ewingtown, a relatively large complex along Red Lion Branch, and a small pond along Busic Church Road.

There have been at least 14 wetland restoration projects in the watershed from 1998-2003. Restoration has primarily been carried out by private landowners in partnership with Ducks Unlimited, the U.S. Fish and Wildlife Service, and agricultural cost share programs. The total acreage is 174.5 acres, most of which was restored as riparian forested wetlands. There were approximately 31 acres established as emergent wetlands for wildlife habitat.

Sites for restoration:

- Restore wetlands and streams within the headwaters.
- Some hydric soils (Bibb) were found suitable for pasture if drained. Conversion of drained pastures may provide an opportunity for restoration. There are likely fewer areas of hydric soils in cropland than in lower Eastern Shore Counties, due to the narrow width of the hydric soils in this watershed. Sites on Portsmouth and Johnston soils may have the greatest potential for providing water quality benefits if restored, or if preserved as existing wetlands, due to high organic matter content and very poor drainage. Portsmouth soils are often found in depressions, while Johnston soils are located along floodplains. Other very poorly or poorly drained soils with high organic matter may also be more likely to provide water quality benefits as restored wetlands over hydric soil areas with lower organic matter content.
- Sites in the Millington vicinity with low elevations, and former wetlands, should be investigated that may provide some additional attenuation of flood waters while protecting the town structures and railroad bridges and embankment.
- Restore areas within the Green Infrastructure hub, currently in agriculture, to natural vegetation (especially around waterways and large hubs).
- Remove identified fish blockages, including: Cypress Branch / Big Mill Pond, Little Mill Pond, Anover Branch / Jones Lake, unnamed tributary east of Millington / near Peacock Corner, Unicorn Branch / Unicorn Mill Pond, Red Lion Branch / near Rte. 301, Pearl Creek / near Rte. 544 (Shanks, 2005).

Specific protection recommendations include:

- Protect wetlands and streams within the headwaters.
- Protect the oxbow wetland west of Millington

- Maintain forested floodplain and wetland corridors, particularly around Millington.
- Protect Nontidal Wetlands of Special State Concern and their buffers.
- Protect remaining Delmarva bays.
- Protect currently unprotected Green Infrastructure, especially around waterways.
- Protect high priority areas within the Rural Legacy Area.
- Protect additional wetlands within designated Ecologically Significant Areas.
- Protect wetlands used as reference sites in the DNR study of tidal wetland vegetative communities.

Kent Island Bay (02130511)

Background

This watershed is roughly 5,130 land acres (based on MDP 2002 land use GIS data). Nearly half of the land use is developed land (47%), followed by agriculture (29%), forest (19%), and wetland (5%). Note that wetland acreage estimates based on this land use data may be grossly underestimated. Better wetland estimates, as discussed elsewhere in this document, are based on GIS data from DNR.

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

- Estuarine
  - Emergent: 235 acres
  - Scrub shrub: 15 acres
  - Forested: 2 acres
  - Unconsolidated shore: 54 acres
- Palustrine
  - Emergent: 38 acres
  - Scrub shrub: 39 acres
  - Forested: 476 acres
  - Unconsolidated bottom: 20 acres
  - Farmed: 25 acres
- Total: 903 acres

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

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02130511	-7.34	1.50	0	1.00	-4.84

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a “designated use” in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically

listed in COMAR are designated Use I, recreation contact and protection of aquatic life. The estuarine portions of this watershed are designated Use II, shellfish harvesting.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resources goals and therefore needing restoration. Since it is a "Priority" Category 1 watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. Failing indicators include high modeled nitrogen and phosphorus loading, high percent impervious surface (10.9%), high percent unforested stream buffer (87%), high soil erodibility (0.33), and being on the 303(d) List for water quality impairment. Indicators for Category 3 include a high number of wetland-dependent species.

The 2002 Maryland Section 305(b) Water Quality Report, testing whether the waterbody has water quality that can support the designated uses, found inconclusive water quality results for the Kent Island and Chesapeake Bay tidal embayment and tributaries.

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

- *Kent Island Bay* (tidal); nutrients, suspended sediments.

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

Restoration/Preservation

There is no Green Infrastructure within this watershed. According to the Maryland Greenways Commission, proposed and existing greenways include:

- *Queen Anne's County Water Trail*: a proposed water trail along the upper Chester River that would extend around Kent and Wye Islands
- *Matapeake Greenway*: a proposed trail connecting Terrapin Beach Park, Matapeake Harbor of Refuge, and Matapeake County Park
- *Cross Island Trail Park*: an existing recreational trail connecting Terrapin Beach Park with Chesapeake Exploration Center and Kent Narrows Pathways

There are no State-designated Nontidal Wetlands of Special State Concern within the Queen Anne's portion of this watershed.

Specific Restoration Recommendations

- Restore wetlands and streams within the headwaters.

Specific Preservation Recommendations

- Protect wetlands and streams within the headwaters.

- Protect wetlands within designated Ecologically Significant Areas.