

— Environmental — Resources



CHAPTER 5

5. Environmental Resources



VISION

Remain a rural, agricultural, and maritime County that restores, enhances, protects, conserves, and stewards its valuable land, air, and water resources by:

- Conserving and protecting agricultural lands, open spaces, woodlands, wetlands, and wildlife habitat
- Participating in Chesapeake Bay restoration efforts by conserving and protecting water resources and adhering to environmental regulations and low-impact stormwater practices
- Preserving good air quality and viewsapes, including the night sky
- Supporting agricultural, maritime, and tourism industries
- Facilitating environmental education programs to promote energy efficiency, comprehensive recycling practices, clean air and water policies, resource conservation, and sustainable land use practices
- Protecting social and economic assets by enhancing environmental resiliency and mitigating potential effects of climate change

KEY ISSUES

Adequate Public Facilities Capacity Limitations

Climate Change, Sea Level Rise & Increased Storm Severity

Impervious Surface Impacts to Watershed Health

NPDES & MS4 Stormwater Permit Requirements

Hazard Identification & Mitigation

PLAN THEMES



FISCAL RESPONSIBILITY

Leverage funding opportunities related to FEMA CRS & EPA MS4 requirements



SUSTAINABLE GROWTH

Mitigating future effects of climate change



COMMUNITY REVITALIZATION

Direct growth to areas with adequate public facilities



PRESERVATION & CONSERVATION

Encourage reduction in amount of impervious surfaces



HEALTH & RESILIENCE

Planning for a variety of natural hazards

RELEVANT STATE VISIONS



GOALS

The overarching goal for environmental resources is to adopt policies, regulations, legislation, and enforcement procedures and appropriate funding for programs and projects to restore, enhance, protect, and conserve the County's land, air, and water resources, while establishing programs to generate awareness of and support for these measures.

- 5-1 Implement resource protection, conservation, and preservation strategies that promote high water quality and protect aquatic life throughout Queen Anne's County.
- 5-2 Implement conservation, preservation, and regulation strategies including environmental protection and resource conservation measures.
- 5-3 Implement a growth management strategy to direct new and infill development to existing County and Town Growth Areas.

Environmental resources, sensitive areas, water resources, and mineral resources are key components of the County's natural environment, as well as parts of the natural resource-based economy. The County contains 495 miles of shoreline, with wildlife and aquatic habitats, and considerable acreage preserved as County and State parkland, natural areas or open space, agricultural lands, woodlands, wetlands, and a variety of water resources. The land use ethic to preserve natural resources applies sustainable smart growth management strategies, which contribute to the success of maintaining the County as a quintessential rural community through:

- Protection and preservation of sensitive areas and water resources using a variety of land use management tools and techniques;
- Reduction of stormwater runoff through urban and agricultural best management practices (BMPs);
- Reduction of environmental impacts by using best available technology for on-lot septic and public sanitary sewer systems; and
- Protection of quality and quantity of drinking water supplies and through watershed planning.

This chapter approaches land use planning through a lens of water resources management, focusing on preservation of rural agricultural lands and sensitive areas protection. Due to the relationship of various natural resources and interrelationship of **PlanQAC's** various topics, this chapter contains the following required elements: Sensitive Areas Element, Water Resources Element, and Mineral Resources Element.

GUIDING PRINCIPLES & LEGISLATION

GUIDING PRINCIPLES

The following guiding principles provide the framework for protection, preservation, and conservation of sensitive areas, water resources, and mineral resources. These principles provide management of future development for the purpose of sustaining current and future populations, the environment, and economic vitality. These guiding principles include:

- Universal stewardship of the land, water, and air that will result in sustainable communities and protection of the environment.
- Land and water resources are carefully managed to restore and maintain healthy natural systems.
- Concentrate and direct growth to existing Growth Areas to protect environmental resources and take advantage of present water resources and infrastructure to accommodate population and business expansion in an orderly, efficient, and environmentally sustainable manner.
- Stewardship of the Chesapeake and Coastal Bays and land and water resources is the responsibility of government, businesses, and residents for the creation of sustainable and hazard-resilient communities by collaborating to balance efficient growth with resource protection.

- Apply sustainable smart growth principles and best management practices for the purpose of conserving resources, reducing resource consumption, and minimizing impacts on resources.
- Encourage opportunities with respect to the County's resource based economy and eco-friendly development.

LEGISLATION & POLICIES

The State's *Land Use Article*, which incorporates the provisions of HB 1141, requires a plan element to address sensitive areas and water resources contained within the County. The Article requires the County to assess and implement strategies in a Water Resource Element (WRE) that addresses the relationship of planned growth to water resources for wastewater treatment, stormwater management, and safe drinking water. The legislation also requires that jurisdictions direct growth to areas where sufficient wastewater treatment capacity exists or can be expanded to ensure that water quality goals can be achieved.

FEDERAL & STATE REGULATIONS

There are a variety of federal and State environmental protection regulations as well as a variety of environmental stewardship programs. Several key regulations and programs are described as follows:

- **Chesapeake Bay Restoration Act.** The Act and subsequent policies, programs, and regulations address Bay restoration. The Act established the Chesapeake Bay Restoration Fund administered by MDE for upgrading the 66 largest wastewater treatment plants to Enhanced Nutrient Reduction (ENR) standards. The Act established the Septic Upgrade Program to remove nitrogen and the fee paid by onsite sewage disposal system (OSDS) or septic users to fund the upgrade of septic systems through the Septic Upgrade Program.
- **Clean Water Act, Section 404.** The US Army Corps of Engineers (USACE) regulates the discharge of dredged or fill material into wetlands. The ACOE district office determines whether various activities such as placement of fill material, levee and dike construction, mechanized land clearing, land leveling, transportation infrastructure construction, and dam construction require a permit.
- **Forest Conservation Act.** The main purpose of this Act is to minimize the loss of Maryland's forest resources during land development by making the identification and protection of forests and other sensitive areas an integral part of the site planning process. Depending on the type or size of proposed development, Forest Stand Delineations and Forest Conservation Plans may be required.
- **Maryland Department of the Environment, Land Management Administration (LMA).** The LMA is responsible for licensing and permitting processes associated with mining activities, sewage sludge utilization, refuse disposal, groundwater discharge permits for rubble landfills, and other related permitting to protect the environment.
- **Maryland Non-tidal Wetlands Protection Act.** The Maryland Department of the Environment (MDE), Nontidal Wetlands and Waterways Division ensures there is no overall net loss of non-tidal wetland acreage and reviews the following construction activities: grading or filling, excavating or dredging, changing the existing drainage pattern, disturbance of water levels or water table, or destroying or removing vegetation. Permits are required for activities that alter a non-tidal wetland or wetland buffer.
- **Maryland's Stormwater Management Act of 2007.** These regulations, effective May 4, 2009, require Environmental Site Design (ESD) through the use of nonstructural best management practices and other better site design techniques to be implemented to the maximum extent practicable. MDE is charged to implement the provisions of the Act.
- **Maryland Tidal Wetlands Act.** MDE manages tidal wetlands and provides resource protection for the activities such as filling open water and vegetated wetlands, construction of piers, bulkheads, revetments, dredging, and marsh establishment.
- **Policy for Nutrient Cap Management & Trading.** MDE has developed this policy to support restoration of the Bay while accommodating expected population growth.
- **Water Quality Infrastructure Program.** This program, administered by MDE, provides grants and loans for sewage treatment and drinking water system upgrades through the State's Biological Nutrient Removal (BNR) Cost-Share Grants Program, Supplemental Assistance Program, and State Revolving Loan Fund (SRF).
- **Robert T. Stafford Disaster Relief & Emergency Assistance Act.** In 2000, the Stafford Act enacted the Disaster Mitigation Act and, by FEMA's Interim Final Rule published in 2002, established in the *Maryland Code* that each Maryland jurisdiction adopt and maintain a Hazard Mitigation Plan (HMP). The HMP ensures eligibility for funding and technical assistance from State and federal hazard mitigation programs. It addresses natural hazards determined to be of high and moderate risk as defined by the updated results of the local hazard, risk, and vulnerability summary. Natural hazards continue to be evaluated during 5-year update cycles and include sea level rise and coastal resiliency planning priorities.

COUNTY REGULATIONS

The following is a listing of key County Code sections that pertain to the environment.

- **Chapter 14:1, Chesapeake Bay Critical Area Act.** The purpose of this Chapter is to establish the Critical Area and to provide special regulatory protection for the land, habitat, and water

resources located within the County's Chesapeake Bay Critical Area. Land use development standards are established to implement the goals, objectives, criteria, and standards set forth in the County's Critical Area Program. This chapter of the County Code is required by the State's *Natural Resources Article* and was approved by the Chesapeake Bay Critical Area Commission.

- **Chapter 14:2, Erosion & Sediment Control.** The purpose of this Chapter is to protect, maintain, and enhance the public health, safety, and general welfare by establishing minimum requirements and procedures to control the adverse impacts associated with accelerated soil erosion and resultant sedimentation. Minimizing soil erosion and off-site sedimentation minimizes damage to public and private property and assists in the attainment and maintenance of water quality standards. The Chapter's provisions in the County Code were adopted pursuant to the State's *Environmental Article*.
- **Chapter 14:3, Floodplain Management.** The purpose of this Chapter is to protect human life, health, and welfare; encourage utilization of construction practices to prevent or minimize future flood damage; minimize flooding of water supply and sanitary sewage disposal systems; maintain natural drainage; reduce financial burdens by discouraging unwise design and construction in areas subject to flooding; minimize need for rescue and relief efforts associated with flooding; minimize prolonged business interruptions; minimize damage to public facilities and utilities; reinforce those building in and occupying special flood hazard areas should assume responsibility for their actions; minimize impact of development on adjacent property within and near flood prone areas; provide and maintain flood storage and conveyance functions; minimize development impact on the natural and beneficial functions of floodplains; prevent floodplain uses that are hazardous or environmentally incompatible; and meet participation requirements of the National Flood Insurance Program (NFIP).
- **Chapter 14:4, Stormwater Management.** The purpose of this Chapter is to protect, maintain, and enhance the public health, safety, and general welfare by establishing minimum requirements and procedures that control the impacts associated with increased stormwater runoff. The goal is to manage stormwater to maintain predevelopment runoff characteristics after development and to reduce stream channel erosion, pollution, siltation and sedimentation, and local flooding.
- **Chapter 18:1, Zoning & Subdivision Regulations.** Article IX of the County's Zoning and Subdivision Regulations contains resource protection standards for floodplains, steep slopes, streams and stream buffers, wetlands, erosion hazard areas, woodlands, and habitats of threatened and endangered species.
- **Chapter 18:2, Forest Conservation Act.** The purpose of this Chapter is to ensure that high-quality forested areas are retained and appropriate areas afforested by requiring consideration and protection of forest resources early in the design phase of development projects located outside the Chesapeake Bay Critical Area, with an overall goal of minimizing the loss of forested areas due to development activities that result in land use change. This Chapter of the County Code is required by the State's *Natural Resources Article*.
- **Chapter 18:3, Development Impact Fees.** This Chapter establishes uniform procedures for impact fees imposed on new development; requires new development to contribute its fair and proportionate share toward costs of capital improvements necessitated by such development; provides a means to finance public facilities needed to accommodate new development in a safe and timely manner; ensures new development reasonably benefits from the appropriation of impact fee funds to public facilities; implements **PlanQAC** and the County's capital budget by ensuring adequate public facilities are available in a timely and well-planned manner; and ensures all applicable legal standards and criteria are properly incorporated.
- **Chapter 19, Nuisances; Conduct of Agricultural & Seafood Operations.** Regulations within this Chapter, particularly those more commonly known as *Right to Farm* and *Right to Conduct*

Seafood Operations are discussed in **Chapter 8—Economic Development & Tourism**.

- **Chapter 24, Sanitary District; Water, Sewers & Septic Tanks.** This Chapter establishes the County Sanitary District and includes provisions for development; regulations related to benefit assessments for water supply, sewerage, and drainage systems; establishes the County’s authority to enact related charges and rates; and authorizes bonds and borrowing authority. It also provides for the establishment of Water and Wastewater Subdistricts along with their associated rates and charges. The Chapter also establishes regulations for removal and disposal of septic tank effluent, general septage regulations, and violations/penalties. The Chapter goes on to regulate sewer use including inspections, public sewer hookups, use of public sewers, private wastewater systems, multi-use wastewater disposal systems, and establishes prohibited acts, violations, and penalties.
- **Chapter 28, Adequate Public Facilities.** While pertinent to **Chapter 4—Environmental Resources**, the adequate public facilities regulations are initially discussed in **Chapter 3—Community Facilities & Services**.

providing unique wildlife habitat, flood control, and natural water filtration.

- Woodlands and forested lands provide wildlife habitat, ecological balance, and (in some cases) recreational opportunities for residents.
- Further protection of wetlands, both tidal and non-tidal, will have a positive impact on targeted ecological areas, wildlife habitat, flood control stream buffers, and water quality.
- Further protection of woodlands or forested lands will have a positive impact on wildlife habitats, contribute to ecological balance, and offer recreational opportunities for residents.
- Development in environmentally sensitive areas should use techniques to reduce impacts on water quality, wildlife habitats, and shorelines.
- Preservation of wetlands and utilizing low impact design development techniques within groundwater recharge areas minimize impacts on life sustaining resources.
- Creating living shorelines will have a positive impact on both land and water resources.
- The quality of water is directly related to the sustainability of aquatic habitats, such as those for shellfish and fisheries, which are resources for the County’s maritime industry.

Map 5-1, Sensitive Areas, shows a number of these environmentally sensitive areas.

SENSITIVE AREAS & NATURAL RESOURCES

Environmentally sensitive areas include streams and stream buffers, floodplains, areas of mapped sea level rise inundation, wetlands, groundwater, habitats of threatened and endangered species, and steep slopes. These sensitive areas can be vulnerable to adverse impacts from development activities, residential uses, and certain types of agricultural practices. While this section takes a broader look at natural resources, the *Annotated Code of Maryland* requires “sensitive areas” to be discussed, including tidal and nontidal wetlands, 100-year floodplains, habitat protection areas, buffers, stream buffers, and modified buffer areas.

Planning issues and opportunities related to environmentally sensitive areas include:

- Wetlands, both tidal and non-tidal, offer benefits to ecological resources, such as

STREAMS & BUFFERS

Rivers and streams are valuable to the County in many ways. For example, streams are used for irrigation, provide important spawning grounds for finfish and shellfish, and help support other kinds of wildlife. Streams also support commercial and recreational fishing and attract outdoor enthusiasts such as hunters, boaters, and birdwatchers. Streams are categorized based on the balance and timing of the stormflow and base flow components. These include:

- Ephemeral streams—flow only during or immediately after periods of precipitation. They generally flow less than 30 days per year.
- Intermittent streams—flow only during certain times of the year. Seasonal flow in an

intermittent stream usually lasts longer than 30 days per year.

- Perennial streams—flow continuously during both wet and dry times. Baseflow is dependably generated from the movement of groundwater into the channel.

Stream buffers are areas along the lengths of stream banks, established to protect streams from human disturbances. Buffers are a best management technique that reduce sediment and nitrogen, phosphorus, and other runoff pollutants by acting as a filter, thus minimizing damage to streams. Stream buffers also improve habitat for fish and other stream life.

The effectiveness of buffers depends on their width and other factors such as steep slopes, soil erodibility, and wetlands. The basic structure of a stream buffer is broken into three zones that differ in function, width, vegetative target, and allowed uses. In the eastern and northwestern U.S., the streamside zone is often maintained as mature forest, with strict limitations on all other uses. The streamside zone also produces the shade and woody debris that is so important to stream quality and biota, as well as provides important flood control measures. The middle zone is typically a 50-100 foot-wide forested area that is managed to allow some clearing. The outer zone, usually about 25 feet wide, is ideally forest but also can include turf. The three-zone buffer is variable in width and should be increased to allow for protection of special areas such as wetlands and the floodplain.

For managing forest harvest operations, the Maryland Forest Service defines adequate buffer width as at least 50 feet forested on each side of a stream, with an increase of four feet for each percent slope.

Within the County's Chesapeake Bay Critical Area, existing regulations require an undisturbed minimum buffer of 100 feet landward from the mean high water line of tidal waters, top of bank tributary streams, and tidal wetlands; however, the buffer may be expanded up to 300 feet to include any contiguous sensitive areas, highly erodible soils, or steep slopes. Outside of the Critical Area, the County requires a standard perennial stream buffer of 100 feet and an intermittent buffer of 50 feet.

CHESAPEAKE BAY CRITICAL AREA

The Chesapeake Bay Critical Area is the lands that lie within 1,000 feet of the Chesapeake Bay and its tributaries as measured from the mean high water line of tidal waters (see *Map 5-3, Chesapeake Bay Critical Areas*). Initially based on the 1973 National Wetlands Inventory maps, the official Critical Area maps were updated in each jurisdiction in Maryland by the Critical Area Commission. The Queen Anne's County official Critical Area map was updated in 2019. Land within the Critical Area is classified by its predominant use and intensity of development and is designated as one of the following:

- **RCA—Resource Conservation Area.** An area characterized by nature-dominated environments including wetlands, forests, abandoned fields, and resource-utilization activities (e.g., agriculture, forestry, fisheries activities, aquaculture).
- **LDA—Limited Development Area.** An area that is currently developed with low- or moderate-intensity uses, which contains areas of natural plant and animal habitats and where the quality of runoff has not been substantially altered or impaired.
- **IDA—Intensely Developed Area.** An area where residential, commercial, institutional, or industrial land uses are predominant and where relatively little natural habitat, if any, occurs.

Approximately 41,790 acres of land in the County fall within the Chesapeake Bay Critical Area. Development is not prohibited in the Critical Area, but it is reviewed for compliance with the appropriate designation. The most restrictive is the RCA, which limits densities no greater than one dwelling unit per 20 acres and limits lot coverage generally to a maximum of 15% of the lot area (though nonconforming lots of record dating back to 1985 may hold higher lot coverage limits). RCAs are generally undeveloped areas or areas characterized by agricultural use, forests, or other natural resources. Approximately 31,806 acres of the County's land area are designated as RCA with a total of 768 acres, or 2.4% of the RCA area estimated to be impervious.

Within very prescriptive regulatory parameters established through COMAR and the local program, the County may approve additional growth and development in certain parts of the Critical Area by

changing the classification from RCA to either LDA or IDA or from LDA to IDA. Growth allocation is used to accommodate more intense land uses and development than what would have been permitted based on the existing classification. Each county is allotted a finite number of acres that can be used to reclassify land.

The density and intensity of use in the LDA and IDA are established by the underlying zoning classifications. Lot coverage is generally limited to a maximum of 15% of the lot area in the LDA (though nonconforming lots of record dating back to 1985 may hold higher lot coverage limits). There are no lot coverage limits within the IDA; however, minimizing the destruction of forest and woodland vegetation and controlling sediment, reducing runoff, and removing nutrients are encouraged. Properties within the IDA are subject to water quality improvement requirements to offset any increased lot coverage. Approximately 8,417 acres of land are designated as LDA with a total of 1,358 acres, or 16.1% of the LDA area estimated to be impervious. Approximately 1,568 acres of land are designated as IDA with a total of 499 acres, or 31.9% of the IDA area estimated to be impervious.

Areas of lot coverage include building coverage, roadways, and parking lots along with other types of manmade material such as driveways (including stone), sidewalks, patios, and tennis courts. Lot coverage/impervious surfaces can contribute to reductions in water quality, wildlife habitats, and other environmentally sensitive areas (see *Appendix A—Acronyms & Definitions* for lot coverage and impervious surface definitions).

Table 5-1 depicts impervious area within Critical Areas for IDA, LDA, and RCA designated areas of the County. Currently, 6.3% of total lands within the Critical Area are impervious.

WETLANDS

A wetland is a low-lying land area that is saturated with water, either permanently or seasonally, and contains hydric soils and aquatic vegetation. Wetlands may be permanently flooded by shallow water, permanently saturated by groundwater, or periodically inundated or saturated for varying periods during the growing season in most years. Many wetlands are the periodically flooded lands that occur between uplands and salt or fresh waterbodies (e.g., lakes, rivers, streams, estuaries). Other wetlands may be isolated in areas with seasonally high water tables that are surrounded by upland or occur on slopes where they are associated with groundwater seepage areas or drainageways. Wetlands are important natural resources providing numerous values to society, including fish and wildlife habitat, flood protection, erosion control, and water quality preservation. Wetlands comprise a range of environments within interior and coastal regions of Maryland.

According to the National Wetlands Inventory survey, the County contains approximately 28,946 acres of tidal and nontidal wetlands, which is about 12.2% of total County land area. The County’s wetlands are two main types, estuarine and palustrine. The most abundant type is palustrine or freshwater wetlands, which may be either tidal or nontidal, and represent 81.9% of the County’s total wetlands, equivalent to 23,701.7 acres. Estuarine wetlands (salt and brackish wetlands) represent 17.7% of the County’s total wetlands, equivalent to 5,112.2 acres. There is a very small percentage of lacustrine wetlands (117.5 acres or 0.4%) and riverine wetlands (14.1 acres or less than 0.1%).

These coastal wetlands are extremely important to the Chesapeake Bay ecosystem and the economy of the County.

Table 5-1. Impervious Surface by Critical Area Designation*

Critical Area	Impervious Area		Undeveloped Land		Total Acres
	Acres	%	Acres	%	
IDA—Intensely Developed Area	499.3	31.9%	1,068.3	68.1%	1,567.6
LDA—Limited Development Area	1,357.8	16.1%	7,059.7	83.9%	8,416.9
RCA—Resource Conservation Area	767.8	2.4%	31,038.1	97.6%	31,805.9
Total Critical Areas	2,624.3		39,166.1		41,790.4

Source: Queen Anne’s County, LGE & MDE/MDP Datasets. *This dataset is consistent with all impervious surface data found within this Plan and does not reflect lot coverage calculations, which must be captured on a parcel-by-parcel basis per the Critical Area regulations.

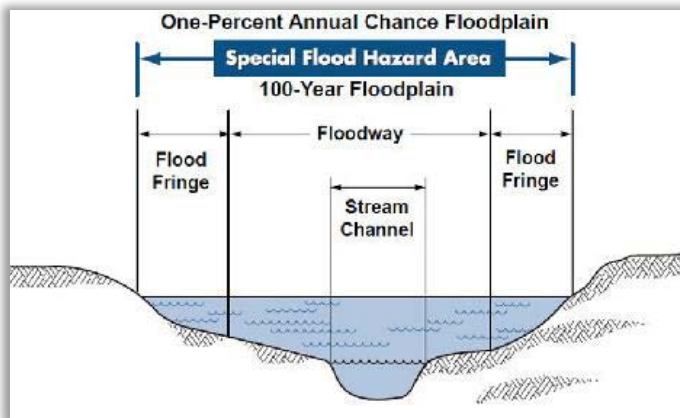
Map 5-1, Sensitive Areas shows the general location of mapped wetlands in the County. While the United States Geological Survey (USGS) and the Maryland Department of Natural Resources (DNR) both provide generalized mapping of wetland areas, the specific location and extent of wetlands require a site-by-site analysis. Final delineation of wetland locations is required as part of the development review process.

The USACE and MDE jointly regulate the wetland activities in the County. That regulation occurs through Section 404 of the Clean Water Act, Maryland Nontidal Wetlands Protection Act, Maryland Tidal Wetlands Act, and the Waterway and 100-year Floodplain Construction Regulations.

FLOODPLAIN & FLOOD HAZARDS

A flood is a natural event for rivers and streams and occurs when a normally dry area is inundated with water. Excess water from snowmelt or rainfall accumulates and overflows onto the stream banks and adjacent floodplains. As illustrated in the figure below, floodplains are lowlands, adjacent to rivers, streams, and creeks that are subject to recurring floods. Flash floods, usually resulting from heavy rains or rapid snowmelt, can flood areas not typically subject to flooding, including urban areas. Extreme cold temperatures can cause streams and rivers to freeze, causing ice jams and flood conditions.

Figure 5-1. Floodplain Characteristics



Floods are considered hazards when people and property are affected. Nationwide, hundreds of floods occur each year, making it one of the most common hazards in all 50 states and U.S. territories. In Maryland, flooding occurs commonly and can occur during any season of the year from a variety of sources. Most injuries and deaths from flooding happen when people are swept away by flood

currents and most property damage results from inundation by sediment-filled water. Fast-moving water can wash buildings off their foundations and sweep vehicles downstream. Pipelines, bridges, and other infrastructure can be damaged when high water combines with flood debris. Basement flooding can cause extensive damage. Flooding can cause extensive damage to crop lands and bring about the loss of livestock. Several factors determine the severity of floods including rainfall intensity/duration, topography, and ground cover.

River floodplains and coastal areas are the most susceptible to flooding, however, it is possible for flooding to occur in areas with unusually long periods of heavy rainfall. Flood types include:

- **Riverine Flooding** originates from a body of water, typically a river, creek, or stream, as water levels rise onto normally dry land. Water from snowmelt, rainfall, freezing streams, ice flows, or a combination thereof, causes the river or stream to overflow its banks into adjacent floodplains. Winter flooding usually occurs when ice in the rivers creates dams or streams freeze from the bottom up during extreme cold spells. Spring flooding is usually the direct result of melting winter snowpacks, heavy spring rains, or a combination of the two.
- **Flash Flooding** occurs anywhere when a large volume of water flows or melts over a short time period, usually from slow moving thunderstorms or rapid snowmelt. Because of the localized nature of flash floods, clear definitions of hazard areas do not exist. These types of floods often occur rapidly with significant impacts. Rapidly moving water, only a few inches deep can lift people off their feet, and only a depth of a foot or two, is needed to sweep cars away. Most flood deaths result from flash floods.
- **Urban Flooding** is the result of development and the ground's decreased ability to absorb excess water without adequate drainage systems in place. Typically, this type of flooding occurs when land uses change from fields or woodlands to roads and parking lots. Urbanization can increase runoff two to six times more than natural terrain. The flooding of developed areas may occur when the amount of water generated from rainfall and runoff exceeds a storm water system's capability to remove it.

- **Nuisance Flooding** is associated with high tides that flow back through the stormwater system, increasing or raising the level of groundwater, and overtopping the banks and edge of waterways. Nuisance flooding is an indicator of rising water levels in the Chesapeake Bay and its tributaries. Areas that were previously dry now flood during high tides because the water elevation is high enough to lap over the banks of waterways through outfalls that were previously high enough to prevent backflow, while allowing outflow.

flood insurance. Buildings built to these regulations have lower flood risk and insurance rates.

The County participates in the NFIP; the effective date of its FIRM and FIS is November 5, 2014. Barclay, Centreville, Church Hill, Millington, Queen Anne, and Queenstown also participate in the NFIP.

FEMA maps can be used to identify the expected spatial extent and elevation of flooding from a 1% and 0.2% annual chance event. Almost all of the municipalities in the County were determined to have special flood hazard areas (SFHA), with the exception of Barclay, Sudlersville and Templeville.

FLOOD RISK MAPPING

The National Flood Insurance Program (NFIP) produces Flood Insurance Rate Maps (FIRMs) nationwide, which are a community’s official map where the Federal Emergency Management Agency (FEMA) has delineated both the special hazard areas and the risk premium zones applicable to the community. The NFIP underwrites flood insurance coverage using the information from the FIRM and the associated Flood Insurance Study (FIS). Communities that adopt and enforce regulations that meet or exceed NFIP criteria are eligible for

FLOOD ZONES

The County is prone to various forms of flooding; FEMA’s Digital Flood Insurance Rate Map (DFIRM) contains flood inundation areas that are depicted as flood zones. Flood zones include Zones A, AE, AO, VE, and X (shaded and un-shaded). The County’s floodplain is shown on **Map 5-5, Flood Hazard Areas**. According to this information, the County has 5,341 acres of SFHA (1% annual chance or 100-year floodplain), which amounts to 2.2% of the County.

Table 5-2. FEMA Flood Zones

Flood Zone	Description
SFHA—High Risk Areas	
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
AO	River or stream flood hazard area, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1-3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage.
VE	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
Moderate Risk Areas	
X (Shaded) 0.2% or 500-Year	Moderate flood area(s), shaded area(s) shown on FIRM, are the areas between the limits of the base flood and the 0.2% annual chance (or 500-year) flood.
Minimum Risk Areas	
X (Unshaded)	The areas of minimal flood hazard, which are areas outside the SFHA and higher than the elevation of the 0.2% annual chance flood, are labeled Zone X (unshaded).

Source: Federal Emergency Management Agency

FLOOD INSURANCE

Flood insurance is also available to County residents and businesses through the NFIP, which offers flood damage protection to communities that have worked to manage and reduce the dangers of local flooding.

To this end, the County applied to FEMA for participation in its Community Rating System (CRS), which is a flood insurance discount program that rewards higher regulatory standards, public outreach, emergency preparedness, and open space preservation to reduce flooding risk and increase resiliency. While the pandemic delayed review, application completion is expected in Fall 2021.

SPECIES HABITATS

Federal and State laws protect habitats of threatened and endangered species. Since much of the development activity that affects species habitat is processed through the County, it has an important role to play in helping property owners comply with federal and State laws. Protecting animal and plant species and their habits is important for many reasons:

- Animal and plant species contribute to the County’s environmental quality, making it an attractive place to live
- An abundance of animal and plant species support outdoor recreational activities such as hunting, boating, wildlife viewing, and hiking

The Wildlife and Heritage Service Natural Heritage Program (WHS) tracks over 1,250 native plants and animals that are among the rarest in Maryland and most in need of conservation efforts as elements of the State’s natural diversity. Lists of rare, threatened, and endangered animals and plants, including federally listed species are maintained by the WHS, statewide, which officially recognizing 566 species and subspecies as endangered, threatened, in need of conservation, or endangered extirpated:

- **Endangered.** A species whose continued existence as a viable component of Maryland’s flora or fauna is determined to be in jeopardy.
- **Threatened.** A species that appears likely, within the foreseeable future, to become endangered in Maryland.
- **In Need of Conservation.** A species whose population is limited or declining in Maryland, such that it may become threatened in the

foreseeable future if current trends or conditions persist.

- **Endangered Extirpated.** A species that was once a viable component of the flora or fauna of Maryland, but for which no naturally occurring populations are known to exist.

As of July 2019, within the County, 13 animals and 28 plants are listed (see *Table 5-3*). Of these, two animals and one plant species are listed as endangered under the federal *Endangered Species Act*, which include the Dwarf Wedge Mussel, Leatherback Sea Turtle, and Canby’s Dropwort.

To assist in identifying the potential habitats for these species areas, DNR designates Sensitive Species Project Review Areas (SSPRA). SSPRA represents the general locations of documented rare, threatened, and endangered species, and other areas of concern including Critical Areas, Natural Heritage Areas, Listed Species Sites, and Nontidal Wetlands of Special State Concern. The County Planning and Zoning Department determines whether a development project might affect a habitat and if so, the project applicant is referred to the Maryland Natural Heritage Program. The project applicant then works with the Heritage Program or other appropriate agencies to minimize any project impacts on species habitat. Typically, this involves project design changes affecting features such as access, lot layout, or stormwater management. **Map 5-4, Species Habitats**, includes significant wildlife assessment areas in the County including SSPRAs, forest interior dwelling species habitats, and green infrastructure.

Table 5-3. State Listed Species in the County

Category	Plants	Animals
Endangered	18	7
Threatened	6	1
In Need of Conservation	0	5
Endangered Extirpated	4	0
Total	28	13

Source: Maryland Department of Natural Resources—List of Rare, Threatened & Endangered Species (July 2019)

FOREST INTERIOR DWELLING SPECIES

Forest Interior Dwelling Species (FIDS) are those species that require large blocks of forests to survive and maintain sustainable populations. This diverse group of birds includes tanagers, warblers, vireo, as well as short-distance migratory birds such as woodpeckers, hawks, and owls. Many factors have

contributed to the decline of FIDS; however, the loss and fragmentation of forests on the breeding grounds is a major contributor for this decline. In general, FIDS are not well adapted to compete with species that evolved along forest edges and openings. The fragmentation of large forest tracts through forestry or land development threatens the habitat needed for long-term survival of these species and exposes them to predators or competing species.

When forests are under extreme stress, individual species and their habitats become threatened, thereby endangering the health of the forest. The plants, animals, and forests are essential to maintaining biological diversity in this region. The distance between blocks of forests influences the abundance of many FIDS. Some species can survive in smaller forests if they are connected to other areas via corridors.

LIGHT POLLUTION

Planning for light pollution is crucial to the preservation and maintenance of wildlife habitat and ecological systems in the County. Light pollution is the result of excessive artificial lighting such as sky glow, glare, and light clutter during nighttime hours. Sources of artificial lighting include exterior and interior lighting, including those for commercial and industrial properties, and streetlights.

The International Dark Sky Association (IDSA) has been educating communities on positive outcomes that can result from minimizing light pollution for interior as well as exterior environments. The reduction of light pollution can significantly benefit local ecosystems, whose organisms depend on natural daylight and night darkness as compasses for their natural activities. It can reduce disorientation and hazards that birds and other wildlife experience when directly exposed to artificial lighting. It can also preserve predator-prey relations, migratory and reproductive habits, and lessen harm to the physical well-being of animals, plants, fish, reptiles, and their natural habitats. In addition, decreased exterior lighting can result in lower energy costs, improved visibility for astronomical observations, improved aviation safety, and reduced smog levels. Allowing presentation of a more natural nighttime environment can contribute to a greater appreciation and understanding of another aspect of community life. Reduced interior light pollution can also improve circadian rhythms and sleep cycles.

Lighting is often installed to improve safety, either in traffic situations or for protection from crime. Often such lighting actually reduces security by interfering with visibility—the wrong kind of lighting actually reduces security as it interferes with a person's ability to see dangers, including roadway threats as well as personal security dangers. Effective, efficient lighting improves visibility. Quality lighting, rather than a large quantity of poor lighting, should be the goal for improving security.

Benefits of the reduction of artificial lighting can be realized by minimizing the usage of outdoor lighting by using timers, installing dark-friendly lighting infrastructure, and reexamining lighting plans for commercial, entertainment-based, and other institutions that use nighttime lighting.

CONSERVATION LANDS

Map 4-5, Conservation Lands, identifies areas of conservation lands based on the status of properties preserved through a variety of State and County preservation and conservation programs, which are defined in **Appendix A—Acronyms & Definitions**:

- Maryland Agricultural Land Preservation Foundation (MALPF) Easements
- Maryland Environmental Trust (MET)
- Rural Legacy Easements and Areas
- Private Conservation
- Transfer of Development Rights (TDR) Sending Areas
- Deed Restricted Open Space
- Non-Contiguous Open Space

Chapter 4—Land Use includes the discussion of Priority (or agricultural) Preservation Areas, required by the *Land Use Article*.

FOREST & WOODLANDS

According to the County's 2019 Land Use/Land Cover classifications, Queen Anne's contains approximately 72,588 acres of forest coverage, which represents roughly 30% of the County's land mass. In addition to enhancing the County's rural character, some of the forested lands are owned and operated by timber companies making silviculture (the growing of trees) an integral part of industry. Due to the nature of forested land use and limited development potential of the soil types typically associated with extensive woodlands, fewer County services are necessary in largely forested areas.

Additionally, large forest tracts provide a variety of ecological benefits.

Development on large lots consumes land at a significantly faster rate than other more concentrated land use types. It results in the loss and fragmentation of forest land, which decreases ecological diversity, economic benefits, and recreational value. Particularly if built using septic systems, it increases the threat of damaging water quality and biodiversity. To mitigate the loss of forested areas while still enabling growth in Maryland, the *Forest Conservation Act of 1991* was passed.

Locally, requirements to conserve forest resources in the development review process are governed by the County's Forest Conservation Act (*County Code §18:2*). These conservation standards require that any major or minor subdivision (other than administrative), major or minor site plan, grading permit, or sediment control permit on a tract of land at least 40,000 square feet is evaluated for impacts on forests and mitigation measures put into place.

Development standards and requirements established by the Forest Conservation Act are intended to foster more sensitive development activity occurring in forested areas, as well as to minimize potential adverse impacts of development activities on water quality. The Act's provisions place limitations on clearing natural vegetation and provisions for preservation of native vegetation, where possible. These provisions also establish a ratio of mitigation required for activities on parcels of record if the activities are not exempt from the Act.

It is important to note that the State's *Forest Conservation Act* does not achieve no net loss of forests. Instead, it slows the rate of forest loss through retention, afforestation/reforestation, offsite planting, mitigation banking, credits, new plantings in banks, and fee-in-lieu. In 2013, the Maryland General Assembly further clarified that it is the policy of the State to achieve "no net loss of forest," meaning at least 40% of all land in Maryland is to be covered by tree canopy. The County should consider establishing its own no net loss of forest policy.

The County's Forest Conservation Act also establishes the Queen Anne's County Local Conservation Fund, where applicants may contribute payments in lieu of the afforestation or reforestation

if they demonstrate to the Planning Director's satisfaction that on- or off-site afforestation or reforestation (including payment into a forest mitigation bank) cannot be reasonably accomplished. Applicants may also contribute credits from an available and approved forest mitigation bank within the County if they demonstrate that requirements cannot be reasonably accomplished; credits are to be debited from an available and approved forest mitigation bank prior to subdivision recordation or issuance of any required permit.

In addition, the County's *Zoning and Subdivision Regulations* include Resource Protection Standards (*Article IX*), which address limitations of woodland disturbance related to development activity.

In October 2019, the State enacted legislation that updated the *Natural Resources Article §5-1610, Forest Conservation Fund*, which required the County to implement a Forest Mitigation Plan and Accounting Procedure. This Plan prioritizes a plan of action to maintain a viable Forest Conservation program by exploring land acquisition, forest banking, GIS tracking, and an increased forest conservation fee in lieu rate.

STEEP SLOPES

The County is very flat. According to a *Custom USDA/NRCS Soil Resource Report for Queen Anne's County* (June 2021), the only mapping unit with over 15% slopes is Downer soils found in broad ridges between valleys, hills, and ridges of the Northern Atlantic Coastal Plain. Land mapped as Downer soils range from 15-30% slopes. This series covers approximately 2,484 acres of the County (0.8%), primarily along the Southeast Creek and Corsica River. Given the County's topography, detailed regulations governing protections of steep slopes are not necessary; however, the County's Zoning and Subdivision Regulations prohibit development activities on slopes of 15% grade or higher (see *§18:1-62, Steep Slopes*).

HAZARD MITIGATION

Hazard mitigation involves reducing the risks of natural hazards and their associated damage to people and property. The County developed a detailed *Multi-Jurisdictional All-Hazard Mitigation Plan* (HMP) in 2018 that addresses the natural hazards that are most likely to affect Queen Anne's.

HAZARD IDENTIFICATION

Planning for hazard mitigation begins with historical hazard occurrences in the County. The natural hazards identified include flooding (riverine, urban, coastal), sea level change, hurricanes and coastal erosion, drought and extreme heat, severe winter weather, wildfire, thunderstorms and lightning, high wind, earthquake, and tornado. Historical records are used to identify the level of risk associated with these hazards in the County.

RISK ASSESSMENT

The identified hazards were ranked to provide structure and prioritize the mitigation goals and actions discussed in the HMP. In addition to the five categories established for the ranking criteria in the previous plan, local risk perspective was added. These criteria were used to evaluate hazards and identify the highest risk hazard.

The hazards with the highest risk in the County are high wind and flooding. **TABLE 5-4, OVERALL RISK RANKING** shows the overall risk potential identified in the HMP; each hazard is further fitted into one of three categories for the final hazard risk summary: high risk (red), moderate risk (orange), and low risk (yellow).

Table 5-4. Overall Risk Ranking

Hazard	RF Rating	Ranking
High Wind	4.2	1
Flooding	4.0	2
Hurricane & Coastal Erosion	3.6	3
Drought & Extreme Heat	3.4	4
Sea Level Change	3.3	5
Severe Winter Weather	3.3	6
Temperature Extremes	3.0	7
Thunderstorm & Lightning	2.8	8
Wildfire	2.6	9
Tornado	2.5	10
Earthquake	2.5	11

Source: QAC Multi-Jurisdictional All-Hazard Mitigation Plan (2018)

HIGH WIND

Damaging winds are often called “straight-line” winds to differentiate the damage they cause from tornado damage. Strong thunderstorm winds can come from a number of different processes. Most thunderstorm winds that cause damage at the ground are a result of outflow generated by a thunderstorm downdraft. Damaging winds are classified as those exceeding 50-60 mph.

Everyone is potentially at-risk to damaging high wind events. However, people living in mobile homes are especially at risk. The County’s Construction Codes include a wind design speed of 115 mph for new structures. One of the biggest risks from high wind events is flying debris. Flying debris causes injuries, deaths, and property damage. Wind hazard effects include wind-borne debris, wind driven rain, wind driven storm surge, and wind pressure.

FLOODING

Flooding and flood hazards are discussed earlier in this Chapter (see *Floodplain & Flood Hazards*).

HURRICANE & COASTAL EROSION

Coastal hazards take many forms ranging from storm systems like tropical storms, hurricanes and nor’easters that can cause storm surge inundation, heavy precipitation that may lead to flash flooding, and exacerbation of shoreline erosion to longer term hazards such as sea level rise.

Tropical cyclones, a general term for tropical storms and hurricanes, are low-pressure systems that usually form over the tropics. These storms are referred to as cyclones due to their rotation. Tropical cyclones are among the most powerful and destructive meteorological systems on earth. Their destructive phenomena include very high winds, heavy rain, lightning, tornadoes, and storm surge. As tropical storms move inland, they can cause severe flooding, downed trees and power lines, and structural damage.

Tropical storms and hurricanes are accompanied by a storm surge, an abnormal local rise in sea level. The end result is that water is pushed onto a coastline. For coastal areas, the storm surge is typically the most dangerous and damaging aspect of the storm, often exacerbated by stormwater.

All of the County could be affected by a hurricane or tropical storm. Since they can disrupt power and inundate roads, tropical storms can cause havoc in the entire community. The County’s proximity to the Chesapeake Bay exposes it to significant storm surge with considerable potential for flooding.

EROSION

A side effect of tropical storms is erosion, which is a naturally occurring normal part of nature. Erosion typically occurs when earth’s surface is exposed to the impacts of rainfall or water, causing sediment to be carried away by the water

and deposited at a different location. Erosion also creates a chain reaction causing reduced stream capacity, sometimes resulting in flooding, and helps contribute to a decline in water quality which blocks sunlight and can destroy plant and animal species located in waterways.

The County has had millions of dollars of damage from erosion over the years. It is sometimes difficult to predict and is dependent on many factors such as rain, wind, and human actions. Shoreline erosion can be easily studied and steps taken to prevent further erosion, which might include living shorelines, berms, and rock walls along the water's edge.

Inland erosion is difficult to predict as it can happen anywhere. Areas of concern for inland erosion are hillsides, unprotected surfaces such as construction sites, and areas where logging is occurring. These factors all contribute to the destabilization of the earth's surface by removing soil anchor points such as trees, root systems, and grass.

DROUGHT

Drought is a normal part of virtually all climates, including areas with high average rainfall. It is a period of time when natural or managed water systems do not provide enough water to meet established human and environmental uses because of natural shortfalls in precipitation or stream flow. Although maintaining water supplies for human use is an important aspect of drought management, drought can also have many other dramatic and detrimental effects on the environment and wildlife.

Representative definitions commonly used to describe the types of drought are summarized below:

- **Meteorological drought** is the degree of dryness, expressed as a departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
- **Hydrologic drought** is related to the effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
- **Agricultural drought** is defined in terms of soil moisture deficiencies relative to water demands of plant life, usually crops.

- **Socioeconomic drought** associates the supply and demand of economic goods or services with elements of meteorological, hydrologic, and agricultural drought. It occurs when the demand for water exceeds the supply as a result of a weather related supply shortfall. The incidence of this type of drought can increase because of a change in the amount of rainfall, a change in societal demands for water (or vulnerability to water shortages), or both.

Impacts from the drought hazard include:

- **Agriculture**—Impacts associated with agriculture, farming, and ranching (e.g., damage to crop quality; income loss for farmers due to reduced crop yields; reduced productivity of cropland; insect infestation; plant disease; increased irrigation costs; costs of new or supplemental water resource development; reduced productivity of rangeland; forced reduction of foundation stock; closure/limitation of public lands to grazing; high cost/unavailability of water for livestock; range fires).
- **Water/Energy**—Impacts associated with surface or subsurface water supplies, stream levels or stream flow, hydropower generation, or navigation (e.g., lower water levels in reservoirs, lakes, and ponds; reduced flow from springs; reduced stream flow; loss of wetlands; estuarine impacts; increased groundwater depletion, land subsidence, reduced recharge; water quality effects; revenue shortfalls and/or windfall profits; cost of water transport or transfer; cost of new or supplemental water resource development; loss from impaired navigability of streams, rivers, and canals).
- **Environment**—Impacts associated with wildlife, fisheries, forests, and other fauna (e.g., loss of biodiversity of plants or wildlife; loss of trees from urban landscapes, shelterbelts, wooded conservation areas; reduction and degradation of fish and wildlife habitat; lack of feed and drinking water; greater mortality due to increased contact with agricultural producers, as animals seek food from farms and producers are less tolerant of the intrusion; disease; increased vulnerability to predation; migration and concentration; increased stress to endangered species).

- **Fire**—Impacts associated with forest and range fires that occur during drought events. The relationship between fires and droughts is very complex. Not all fires are caused by droughts and serious fires can result when droughts are not taking place.
- **Social**—Impacts associated with the public, or the recreation/tourism sector (e.g., health-related low-flow problems; loss of human life; public safety from forest and range fires; increased respiratory ailments; increased disease caused by wildlife concentrations; population migrations; loss of aesthetic values; reduction or modification of recreational activities; losses to manufacturers and sellers of recreational equipment; and losses related to curtailed activities).
- **Other**—Drought impacts that do not easily fit into any of the above categories.

EXTREME HEAT

Temperature extremes can occur at almost any time of the year but are most prevalent in the summer and winter. Extreme temperatures can be dangerous due to the way that they affect individuals who are exposed to them. Extreme heat is usually defined through a combination of temperature and humidity. The recorded extreme heat events have occurred from June through September. Prolonged periods of hot temperatures may be associated with drought conditions and can damage or destroy vegetation, dry up rivers and streams, and reduce water quality.

It is evident from past events that extreme heat is dangerous and can cause human related illnesses and death. As temperatures go up so do the number of people hospitalized for heat related illnesses. The elderly, just like small children, are more susceptible to temperature extremes; therefore, it is important to understand how many people are exposed to such conditions, and how many buildings exist, where potential problems could arise should power be lost. Additionally, extreme heat can cause damage to buildings or contents by overheating HVAC or air conditioning systems, contributing to jurisdictional losses; however, it is unlikely that an entire building would be impacted in an extreme heat event. Buildings of significant age may be more susceptible to temperature extremes. Facilities need to be maintained to ensure they operate in appropriate conditions for the people using them.

SEA LEVEL CHANGE

Sea level rise is discussed later in this Chapter (see *Climate Change—Sea Level Rise*).

SEVERE WINTER WEATHER

Severe winter weather can result in the closing of primary and secondary roads, particularly in rural locations, loss of utility services, and depletion of oil heating supplies. Environmental impacts often include damage to shrubbery and trees due to heavy snow loading, ice build-up, and/or high winds, which can break limbs or even bring down large trees. Gradual melting of snow and ice provides excellent groundwater recharge; however, high temperatures following a heavy snowfall can cause rapid surface water runoff and severe flash flooding.

Potential severe winter weather includes blizzards, heavy snow, ice storms, and extreme cold. All structures and facilities located in Queen Anne's County can be considered at risk from severe winter weather. This includes 100% of the County's population and all buildings and infrastructure within the County. Damages primarily occur as a result of cold temperatures, and heavy snow or ice. Due to the regular occurrence of winter storms, they are considered hazards only when they result in damage to specific structures or cause disruption to traffic, communications, electric power, or other utilities.

THUNDERSTORM & LIGHTNING

Severe storms can occur during any season in Queen Anne's County. Thunderstorms, associated with strong winds, heavy precipitation, and lightning strikes can all be hazardous under the right conditions and locations. Strong winds can take down trees, damage structures, tip high profile vehicles, and create high velocity flying debris. Large hail can damage crops, dent vehicles, break windows, and injure or kill livestock, pets, and people. Thunderstorms affect relatively small areas when compared with hurricanes and winter storms. Despite their small size, all thunderstorms are dangerous.

All assets located in Queen Anne's County can be considered at risk from severe storms. This includes all of the County's population and all buildings and infrastructure within the County. Damages primarily occur as a result of high winds, lightning strikes, hail, and flooding. Most structures should be able to provide adequate protection from hail; however, they may suffer broken windows and dented exteriors.

Facilities with back-up generators are better equipped to handle a severe weather situation should the power go out.

WILDFIRE

Wildfires are a common occurrence in Maryland. In an average year, the Maryland Forest Service responds to an average of 325 wildfires that burn more than 3,200 acres of forest, brush, and grasses. Fire departments respond to over 5,000 wildfire incidents per year. While some wildfires can burn hundreds or even thousands of acres, most are smaller in size, burning less than 10 acres. Even these smaller wildfires can threaten lives, homes, other structures, and our natural resources. Each year hundreds of homes and structures are threatened, and dozens are damaged or destroyed by wildfires. The Maryland Forest Service (MFS) is the primary fire control authority for fires affecting natural cover within the state. The Maryland Forest Service also assists local and rural fire companies that lack the resources needed to fight large wildfires.

Wildfires occur in every month in Maryland, but peak in the spring and fall. During these seasons the leaves are off the deciduous trees, allowing sunlight and wind to reach the forest floor and dry the forest fuels. The relative humidity of the air is also drier and, combined with a breeze, creates the conditions for wildfires to spread rapidly. The only natural cause of wildfires is lightning, and this accounts for only 4% of the wildfire ignitions in Maryland. Humans caused the remaining 96% of wildfires. June 30 through July 6 is the peak thunderstorm occurrence for Maryland.

TORNADO

A tornado is a violently rotating funnel-shaped column of air that extends from a thunderstorm cloud toward the ground. Tornadoes can touch the ground with winds of over 300 mph. While relatively short-lived, tornadoes are intensely focused and are one of nature's most violent storms.

Due to the nature of tornado and other high wind events, all jurisdictions within the County are expected to be impacted equally. Nearly 70% of the deaths from tornadoes happen to people located in residential structures. Of these, over 40% are located in mobile homes, which are easily overturned and destroyed due to the low wind resistance of the structure. Even anchored mobile

homes can be seriously damaged when winds gust reach over 80 mph.

EARTHQUAKE

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock usually within the upper 10-20 miles of the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of underground caverns. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of persons, and disrupt the social and economic functioning of the affected area. Earthquake events can, and occasionally do, occur in Maryland; though of much less intensity than those that occur elsewhere in the region or on the west coast. Small magnitude and minimal economic damage of previous earthquake events have not warranted the need for considerable structural retrofits or similar mitigation programs in Maryland.

Most earthquake-related property damage, injuries, and fatalities are caused by the failure and collapse of structures due to ground shaking. The level of damage depends upon the amplitude and duration of the shaking—both of which are directly related to the earthquake size, its location and distance from the fault, and regional geology. Queen Anne's County is located within the minimal level of shaking.

CLIMATE CHANGE

Many areas within Maryland are susceptible to climate change and Queen Anne's County is no exception. Pressing issues that the County faces include heavy precipitation events and increasing temperatures. Mitigation of the effects on the County is an integral part of what will shape Queen Anne's in the coming years.

In 2016, the County completed a *Sea Level Rise and Coastal Vulnerability Assessment Plan*, which identified key vulnerable resources, namely on Kent Island. In 2019, the County continued this analysis through the *County Climate Resilience Planning and Financing Study*, which is ongoing. These planning documents guide the protection of valuable infrastructure from the impacts of climate change. They also acknowledge that Queen Anne's is a county where the environment and environmental protection are important for protecting the rural quality of life, as well as protecting the economic

base provided by agriculture, hunting, tourism, and maritime industries. Key to preserving agriculture is maintaining an adequate land base to support the industry and related businesses (e.g., machinery dealers, agriculture inputs such as fertilizer and chemical providers, seeds and planting material providers, machinery and equipment dealers).

The national impacts of climate change were outlined in the 2021 Intergovernmental Panel on Climate Change report, *Climate Change & Land: An IPCC Special Report*. With drought and wildfire dramatically affecting the American West and Midwest, the East Coast will realize its prominent role in ensuring the viability of the American food market. Preserving the County's prime agricultural soils to support the agricultural industry further solidifies the County's positioning as a national asset.

Project review will include an assessment of the County's vulnerable resources to ensure that the goals of the County's hazard resiliency policy documents are contemplated.

HEAVY PRECIPITATION EVENTS

Climate change is expected to result in more frequent heavy precipitation events. This can lead to flooding, especially in areas with inadequately sized drainage infrastructure. This flooding can result in safety hazards, inaccessible roadways, travel delays, and damage to buildings or other infrastructure. The County's infrastructure and its ability to handle such events plays a contributing role in how effectively the area can be evacuated and how it can prevent damage from these events. Planning for these events also contributes to how successful the County and emergency services can respond to these events. An assessment of the vulnerability of older commercial and residential structures would be helpful to prepare for the anticipated higher frequency of heavy rainfall events.

TEMPERATURE RISE

Another key issue surrounding climate change is a steady rise in temperature. Rising temperatures will result in a longer growing season, heat waves, and more consecutive days where it does not cool off at night. This has many implications for infrastructure and human health. Air conditioning systems in buildings may not be sized appropriately for increasing temperatures and shorter, milder winters can mean residents are dealing with more ticks and

mosquitoes. Of particular concern are vulnerable populations (e.g., elderly, low-income, non-English speakers) who may not have access to air conditioning in the summer. Although temperature is not something that can be controlled, there are ways for the County to prepare for a possible increase. Tree planting and shade contribute greatly to heat dispersion. Making sure buildings are up to code for cooling systems will also mitigate the effects of long-term temperature changes. Educating people on how to deal with heat waves and erratic weather also helps prepare the population for such events and can be a successful way to prevent the dangers of high temperatures.

SEA LEVEL RISE

The rising and spreading of water over normally dry land is referred to as inundation. Scientists use models to develop maps showing the possible impacts of inundation based on various Sea Level Rise scenarios for State's waterways and the land that surrounds them (watersheds). These maps reflect the filling of these watersheds at constant elevations, also referred to as bathtub modeling. In other words, the maps show the water levels rising in the watersheds similar to the filling of a bathtub.

As a County with over 400 miles of coastline, the County's economy and quality of life have historically been linked to its shores, tidal wetlands, farm fields, and the resources of the Chesapeake Bay. Because of its location, low elevations, and dependence on the coast, the County is particularly vulnerable to the effects of Sea Level Rise (SLR), loss of low-lying land and structures, saltwater intrusion into surface water and groundwater, and increased flooding from storm events. Changes in sea levels have the potential to impact existing infrastructure and natural resources in the short-term and also the durability of future development with long-term design life. Long-range planning and accounting for changes in sea level that may be expected in the County will help lead to informed decisions for public and private investments by minimizing risk and potential for damage to both existing and future resources.

Results of the County's *2016 Sea Level Rise and Coastal Vulnerability Assessment* indicate that inundation from SLR will affect a range of resources, including infrastructure, land use, and natural resources, as well as increase the risk to public safety. Three SLR and storm surge scenarios were

mapped to identify areas of vulnerability and risk in the County:

- SLR of 2 ft. + Mean Higher High Water (MHHW)
- SLR of 4 feet + MHHW
- SLR of 2 feet + MHHW plus coastal storm surge

Between 2.6% and 4.1% of the County’s land area could be impacted by a SLR of two feet to four feet, respectively and 6.3% of the County’s land area could see increased temporary impacts by two feet of SLR plus coastal storm surge. Within those potentially inundated areas lie transportation infrastructure, critical facilities, commercial properties, utilities, existing homes, agricultural fields, and expansive stretches of wetlands and wildlife habitat.

The Assessment includes a number of short-, medium-, and long-term adaptation strategies focusing on avoidance, accommodation, protection, retreat, and building adaptive capacity.

To work toward mitigating risks of climate change, a workgroup was established to prioritize vulnerable social, environmental, and economic infrastructure assets that are considered essential to the County. This group continues to draft the *County Climate Resilience Planning and Financing Study*. From this study, resilience action strategies were outlined and prioritized. For the County to move forward and be more resilient regarding climate change, a funding mechanism is needed for implementation.

WATER RESOURCES

The various land use patterns determined by the Maryland Department of Planning (MDP) and the County’s latest Land Use/Land Cover data are used in this Water Resources Element (WRE) to measure the nutrient loadings for nitrogen and phosphorus based on formulas provided by the Maryland

Department of the Environment (MDE) for corresponding land use classifications. These detailed classifications have been reallocated as identified in the table below to support the creation of **Map 4-9, Comprehensive Plan Map: Countywide Land Use**.

Appendix D—Water Resources Element provides a more detailed analysis of water resources in the context of current land use and 2040 projected land use patterns to determine the optimum scenario to minimize impacts on water resources. The analysis addresses the detailed requirements of the Water Resource Element outlined by the MDP and MDE. This section includes summary level information that supports recommended strategies, with supplemental information provided in the appendix.

WATER

Drinking water assessment is typically accomplished by analyzing data on groundwater withdrawal by facility, treatment capacity, and an analysis of each water system’s demand and capacity. MDE issues Groundwater Appropriation Permits (GAP) for facilities or projects that withdraw an average of 10,000 gallons per day or greater. **Table 5-6** provides the GAP Well Withdrawal Limits and 2019 Daily Well Withdrawal quantities by service area. Under the current demands, many of the service areas appear to be near capacity in the GAP Average GPD withdrawal limits and two service areas—Bayside and Thompson Creek—are over capacity in terms of average GPD. New development in these service areas should be carefully considered in terms of water capacity and efforts to increase water capacity production could be evaluated if future growth is anticipated in these areas.

Table 5-5. Comparison of Land Use Patterns & County Land Use Allocations

WRE Analysis—Land Use Patterns	County Growth Areas & Rural Land Use Allocations
Low Density Residential (1-2 units per 5 acres)	Established Residential Areas
Medium Density Residential (2-8 units per acre)	
Industrial/Business Park	Areas within Growth Areas & Business/Employment Areas
Commercial & Mixed Use	
Institutional	
Agricultural & Very Low Density Residential (1 unit/5+ acres)	Rural Agricultural Areas
Forest	
Agricultural & Open Space (includes greenbelts)	Rural Agricultural Areas & Permanently Preserved Lands

WASTEWATER

Public sanitary systems are an integral aspect of any jurisdiction’s ability to handle increased development and growth. With the general trend within Maryland for jurisdictions to discourage well and septic systems and provide public sanitary systems, local government agencies are pressed to provide sufficient capacities to allow for planned growth and future demand.

During this planning cycle, the community finds itself nearing the limits of adequate public facilities, including transportation infrastructure on its state and local roads, the Chesapeake Bay Bridge, local school capacity, and sewerage capacity permit restrictions at the County’s Kent Narrows/Stevensville/Grasonville Wastewater Treatment Plant (KNSG). The existing 3 MGD capacity at KNSG is now nearly fully obligated by estimated existing and future capacity commitments. These commitments are estimated using a combination of the reported actual hydraulic flow through the plant and the reserved flow allocations for unbuilt development. The resulting estimates conclude that

there is an insignificant amount of the estimated remaining capacity available.

KNSG’s maximum discharge or capacity is restricted by nutrients allocated by the Chesapeake Bay TMDL and a State issued NPDES permit. Specifically, KNSG may only discharge 36,547 pounds of nitrogen and 2,741 pounds of phosphorous per year. Nitrogen is the primary constraining factor, and the existing plant is operating with the best available nitrogen removal technology. The NPDES permit is the subject of Federal and State review and renewal every five years. See **Appendix D—Water Resources Element** for a detailed analysis of the KNSG and municipal wastewater treatment facilities.

In addition to infrastructure challenges, the County must contemplate sustainable and resilient land use policies in the face of necessary hazard planning.

Table 5-7 illustrates the demand and capacity of the public wastewater treatment systems for major County communities. As shown in the table, the available capacity of these systems is at or near their limits.

Table 5-6. GAP Well Withdrawal Limits Comparison (GPD)

Service Area	GAP Well Withdrawal Limits		2019 Daily Well Withdrawal		Total 2019 Well Withdrawal GPD
	Maximum GPD	Average GPD	Maximum GPD	Average GPD	
County Facilities					
Bayside	255,000	144,000	206,693	155,490	1,865,875
Bridge Pointe	150,000	100,000	30,410	7,426	89,110
Grasonville	210,000	100,000	91,448	77,035	924,414
Kent Island Village	20,000	15,000	458	210	2,516
Oyster Cove	300,000	200,000	115,968	67,076	804,909
Prospect Bay	195,000	125,000	114,728	71,783	861,392
Queen’s Landing	45,000	27,000	29,042	11,631	139,573
Riverside	8,500	5,100	5,403	4,359	52,312
Stevensville	500,000	350,000	285,484	174,609	2,095,312
Thompson Creek	500,000	210,000	330,620	249,245	2,990,945
Town Facilities					
Centreville	645,000				
Centreville Business Park	500,000	400,000	391,067	317,111	3,805,328
Queenstown	100,000	70,000	82,000	76,000	1,468,000
Sudlersville	17,500				

Source: Queen Anne’s County Department of Public Works; Queenstown Planning Consultant. GAP—Groundwater Allocation Permit. GPD—Gallons Per Day.

Table 5-7. Public Sewer System Demand & Capacity Summary

Facility	Million Gallons per Day (MGD)			Comments
	Design Capacity	Average Daily Flow	Remaining Capacity	
KNSG WWTP	3.000	2.183	(0.110)	Includes residential, commercial, and multi-use commitments of 425,910 gpd (including 14,200 gpd for residential infill), 284,755 gpd of reserve for SKI failing septic areas, and 58,720 gpd reserve for commercial/institutional use.
Queenstown	0.200	0.102	0.098	The current maximum 200,000 gpd capacity of the Queenstown WWTP will be adequate to service the existing, committed, and projected flows of 185,365 gpd for Sewer Service Areas S-1 through S-4. The modular design of the plant allows for expansion as needed. Expansion of up to 400,000 gpd is possible and will be necessary to service long-term future flows including S-5 and S-6 service anticipated at 395,514 gpd. Modification to the discharge permit will be necessary upon increase in capacity.
Centreville	0.542	0.484	0.058	The treatment plant can be expanded to treat approximately 750,000 gpd with approximately \$20M in improvements. With more substantial improvements, the treatment plant can be expanded to treat approximately 1,000,000 gpd. The amount of water and sewer capacity that the Town will provide will have a direct impact on the amount of new development that the Town can accommodate. Capacity currently restricted due to available spray irrigation lands.
Church Hill	0.080	0.051	0.029	The capacity assessment indicates the WWTP will need to be expanded by 2030 in order to provide service for the 2030 forecast and of the full development of the Town. Any expansions of the Church Hill WWTP to accommodate additional growth would also need to improve the quality of treatment at the plant. Improved treatment levels would mean lower concentrations of BODs, suspended solids, phosphorus, and other substances and nutrients.
Sudlersville WWTP & Barclay*	0.200	0.087	0.113	Of the remaining capacity, 40,000 gpd is reserved for the connection to the Town of Barclay. Anticipated flow associated with growth will require expansion of plant capacity.

Source: QAC KNSG Sewer Capacity Estimate (October 2019); Town of Queenstown 2017 Comprehensive Plan and 2021 Queenstown Planning Consultant Data; Town of Centreville 2009 Comprehensive Plan; Town of Church Hill 2010 Comprehensive Plan. Average Daily Flow = flows from 2017, 2018, 2019. *Barclay is dependent on Sudlersville for capacity.

STORMWATER

Changes in land cover can have significant implications on how stormwater runoff affects both overall water quality within a watershed and potential flooding conditions. When land cover is changed from a vegetated/forested condition to impervious surface, stormwater runoff becomes concentrated and the amount of time it takes for the

runoff to reach a waterway is greatly reduced. The runoff volume during a rain event, unless otherwise managed, is able to enter creeks and rivers within the watershed very quickly. Uncontrolled stormwater runoff is a major contributor to decreased water quality as stormwater can carry suspended sediment, excess nutrients, and other pollutants directly to waterways. Additionally, areas covered

with impervious surfaces negate the ability of precipitation to infiltrate into the ground; therefore, stormwater management regulations have been enacted by both the State and the County to address stormwater concerns to ensure that pre-development runoff conditions are emulated by the post-development conditions.

Generating increased rates of runoff through the addition of impervious surface within a watershed has the potential to increase flooding risks to downstream properties; however, current stormwater management regulations stipulate that stormwater flow conditions cannot be increased, creating a flood risk to downstream properties. Both nuisance and urban flooding exacerbate the inadequacies of older stormwater systems and fragmented watersheds. Engineering studies must be submitted for any new development that show how stormwater will be attenuated, treated, and released to accomplish both water quality and water quantity standards.

Numerous studies over the last several decades have shown the link between the presence of impervious surfaces and declines in water quality and habitat conditions. These studies established impervious surface thresholds beyond which irreparable harm is done to watersheds. When thresholds are breached, the quality of human, plant, and animal life is compromised.

Based on the 2016 impervious conditions depicted in **Table 5-8**, watersheds of concern include the Kent

Island Bay and Eastern Bay Watersheds—the impervious cover in these two watersheds has reached 11.8% and 10.4%, respectively.

NPDES & MS4

Since adoption of the *2010 Comprehensive Plan*, Queen Anne’s County was designated as a Phase II Municipal Separate Storm Sewer System (MS4) community. The newly mandated MS4 Phase II permit will add another lens and funded resource layer to approach comprehensive watershed studies to focus future restoration and conservation efforts.

The County will be required to restore 20% (or approximately 200 acres) of impervious area within the County’s Urbanized Area that are untreated or are without modern day maintained stormwater BMPs. Initial restoration requirements will be met by septic elimination efforts on Kent Island, while future restoration efforts will be informed by findings in watershed studies showing critical preservation areas and areas vulnerable to climate change.

Many of the minimum control measures add an additional reporting layer to already mandated stormwater controls such as inspecting and maintaining private and public stormwater Best Management Practices (BMPs) on a regular basis. These include many older stormwater ponds that were built prior to ESD mandates and practices. Educating homeowners on how to regularly maintain their BMPs will be an important outcome of the permit.

Table 5-8. Impervious Surface Coverage – Existing Conditions

Watershed	Total Watershed Acres	Impervious Surface Acres	2016 % Impervious Surface
Corsica River Watershed	23,922.1	1,085.9	4.5%
Eastern Bay Watershed	11,650.6	1,216.0	10.4%
Kent Island Bay Watershed	5,184.5	613.3	11.8%
Kent Narrows Watershed	6,940.2	453.8	6.5%
Lower Chesapeake Bay Watershed	3.4	0.1	2.9%
Lower Chester River Watershed	17,902.7	942.2	5.3%
Middle Chester River Watershed	7,871.7	352.1	4.5%
Southeast Creek Watershed	34,789.0	867.3	2.5%
Tuckahoe Creek Watershed	46,095.3	931.7	2.0%
Upper Chester River Watershed	52,079.3	1,413.7	2.7%
Upper Choptank Watershed	1,928.4	25.2	1.3%
Wye River Watershed	29,671.4	1,021.4	3.4%
Total	238,038.7	8,922.7	3.7%

Source: Queen Anne’s County, LGE & MDE/MDP Datasets.

Outfall inspections will be another new layer of regulation brought on by the MS4 permit. In the coming years, the County will need to develop an outfall inspection program to monitor water quality at mapped outfalls throughout the County. The MS4 permit provides an opportunity for the County to stay informed of the latest innovations in stormwater controls and their corresponding estimates on pollution reduction to the Chesapeake Bay.

MINERAL RESOURCES

The State's *Land Use Article* requires inclusion of a mineral resources element that identifies undeveloped land that should be kept in its undeveloped state until the land can be used to (or assist in) providing a continuous supply of minerals, identifies appropriate post-excavation uses for the land, and incorporates land use policies and recommendations for related regulations.

Mineral deposits of sand and gravel found in the County provide opportunities to support local and regional development and infrastructure needs while contributing to the local economy. Roads, homes, commercial buildings, public facilities and utilities, industrial facilities, and many community amenities require use of these minerals for construction as well as long-term maintenance. The following is a listing of planning issues and opportunities related to mineral resources:

- Include sustainable practices that allow for the use of non-renewable minerals
- Ensure that other uses are compatible with the ability to extract the resource
- Protection of the environment must consider that surface mining alters the natural environment
- Protection of water resources must consider the impacts of surface mining and potential pollution for nearby water resources

In areas where sand and gravel supplies are predominant, the use of zoning tools and techniques such as low-density zoning, Transfer of Development Rights (TDR), Purchase of Development Rights (PDR), and cluster development techniques contributes to the protection of mineral supplies necessary for continued economic growth.

Map 5-12, Potential Mineral Recovery Areas identifies areas with potential mineral resources. Potential areas of sand and gravel deposits in the

County are depicted on the map as Qu, Upland Deposits (Eastern Shore). *County Code Article XII* discusses requirements for mineral extraction in the Critical Area, including areas unsuitable for mineral extraction and mineral extraction performance standards.

FISHERIES ELEMENT

Fisheries are locations for loading, unloading, and processing finfish and shellfish, and for docking and mooring commercial fishing boats and vessels. These fisheries are located to facilitate the commercial harvesting of finfish and shellfish by ensuring reasonable access to the State waterways by commercial watermen. The waters of the Chesapeake Bay and its connecting rivers have historically supported a strong seafood industry. Watermen harvest blue crabs, oysters, and many types of finfish.

The County's commercial marine facilities are located in Kent Island and Grasonville and along the Chester River. These areas accommodate businesses that supply and cater to marine activities and needs. The County is a destination for boating, both for people who choose it as a homeport for their boat and for people who visit by water. There are opportunities to enhance these destinations, grow local businesses, and increase outdoor tourism.

Charter boat services accommodate visitors looking for the opportunity to fish, crab, or cruise the waters of the Chesapeake Bay and the County's rivers, primarily operating out of Kent Island and to the west of Centreville along the Chester and Corsica Rivers and its creeks.

The Maryland Land Use Article requires counties located on tidal waters to include a Fisheries Element that designates areas on or near tidal waters for the loading, unloading, and processing of finfish and shellfish and for the docking and mooring of commercial fishing boats and vessels. Such areas are geographically located to facilitate the commercial harvesting of finfish and shellfish and to ensure reasonable access to the waterways by commercial watermen. Given the historical significance of the seafood industry to the County's economy and to the very fabric of its culture, there are a number of locations that meet the above criteria.

An indicator of the importance that the County places on ensuring and promoting the survival of the seafood industry is its Right to Conduct Seafood Operations regulations, found in the *County Code §19-12:16*. Like many “Right to Farm” laws, the purpose is to recognize the importance and primacy of legally and properly conducted seafood and fishing operations and facilities to minimize nuisance claims. The regulation establishes a Seafood Reconciliation Committee to resolve conflicts that cannot be resolved by the County Health Officer. It also requires that a good neighbor policy is promoted by advising purchasers and users of property adjacent to or near commercial seafood operations of the inherent potential problems associated with such purchase or use.

Despite the current access points and processing facilities, the County’s seafood industry may face challenges to its ongoing viability as a sustainable business sector. One such threat stems from the lack of seasonal migrant workers due to federal immigration policies and is beyond the purview of this Plan. The other threat is the extent of dredging necessary to keep vital channels open for access to the Chesapeake Bay for commercial fishing operations. Silted-in channels can prevent access or cause circuitous routes for the commercial boats to access the Bay, raising operational costs.

BMPs, TOOLS & TECHNIQUES

The protection of environmentally sensitive areas and water resources through conservation of natural resources and ecological systems enhances the quality of life for County residents, resulting in local and regional sustainability. The following indicators may be measured, evaluated, and tracked over time to determine community impact with respect to meeting preservation and water resource goals contributing to the County’s overall sustainability.

- Change in environmentally sensitive lands.
 - Acres preserved versus acres converted to development.
 - Develop no net loss policy for wetlands.
- Change in land use patterns.
 - Track development inside and outside of Growth Areas and towns.
 - Track development within Critical Areas.
 - Assess nitrogen loads and phosphorus loads (point source and nonpoint source) by land use classification.

- Change in agricultural lands.
 - Acres of agricultural lands converted to development versus acres of preserved agricultural land.
- Change in the amount of forested lands.
 - Acres of forest land converted to other uses versus acres of preserved forest land.
 - Develop no net loss policy for forest lands.
- Change in impervious surface.
 - Impervious surface measured at the eight digit watershed level.
 - Update existing Countywide impervious surface analysis.

Other indicators of the health, safety, and welfare of the watersheds within the County include the assessment and measurement of the following factors as part of the comparative ranking assessed for the County with respect to the Clean Water Act Status Report that is maintained and updated online for each state, county, and other jurisdiction by the Environmental Protection Agency (EPA).

- Overall Clean Water Act comparative ranking.
- Priority for regulation.
- Impervious coverage.
- Leading pollutants/stressors of surface waters:
 - Number of impaired water bodies;
 - Other habitat alterations;
 - Impaired biological community;
 - Nutrients, pathogens and sediment; and
 - Leading sources of water quality problems such as nonpoint sources, natural sources and municipal point sources.

Many of the sustainability indicators and measures for future tracking are determined by State, national, and industry standards, as well as population-based formulas. The most current standards will be used to track and measure success of providing, maintaining, and operating necessary transportation facilities and services.

Water resources are best protected when the appropriate best management practices, tools, and techniques are used based on the general characteristics of the landscape and site specific conditions. **Table 5-9** summarizes the Best Management Practices (BMP), Environmental Site Design (ESD), and other tools, techniques, and strategies typically associated with general characteristics of landscapes.

In 2010, the U.S. Environmental Protection Agency (EPA) set limits on the amount of nutrients and sediments that can enter the Chesapeake Bay. In addition to setting these limits, known as total maximum daily loads (TMDLs), EPA required the bay states to develop statewide Phase I Watershed Implementation Plans (WIP). WIPs document the steps, measures, and practices Maryland and its local jurisdictions will take and implement to achieve and maintain the final Chesapeake Bay TMDL by the year 2025.

Pollutant loadings for nitrogen, phosphorus, and sediment were then divided by point source and non-point sources within stormwater, agriculture, and wastewater sectors. All sectors are charged with meeting loading requirements using best management practices.

Table 5-9. Summary of BMPs, Tools, Techniques & Strategies

Strategy	Landscape				
	Agricultural	Natural	Rural Residential	Suburban	Town/Village
Point /Urban Source	—			Expand Water & Wastewater Systems	
Stormwater	BMPs & Ag Best Practices	BMPs, C/P & Ag Best Practices	BMPs & ESD		
Onsite Sewage Disposal	INRT			SE & INRT	SE
Growth Management	PDR & C/P	PDR, C/P & Restrict CA Buffer Dev.	Cluster Dev., ESD & Existing Infrastructure	Public Water & Wastewater, TDR RA	Infill/ Redevelopment, TDR RA
Agricultural	Ag BMPs, SW BMPs & P/C	SW BMPs & P/C	SW BMPs, P/C & Cluster Dev.	TDR RA	
Waterway	Buffers, P/C & Tree Planting	Buffers, P/C, Tree Planting & Living Shore Construction		Buffers, Tree Planting & Living Shore Construction	
Air Deposition	FC & Preserve Green Infrastructure		FC & WLS	FC, WLS, Greenbelts & Trails/Paths	Walkable Communities & Expand Transit

Notes: Ag – Agriculture; BMP – Best Management Practice; C/P – Conservation/Preservation; ESD – Environmentally Sensitive Design; FC – Forest Conservation; INRT – Innovative Nutrient Reduction Technology; RA – Receiving Areas; SE – Septic Elimination; SW – Stormwater; TDR – Transfer of Development Rights; WLS – Wooded Lot Standards

STRATEGIES & ACTIONS

The overarching goal for environmental resources and protection is to adopt policies, regulations, legislation, and enforcement procedures and appropriate funding for programs and projects to restore, enhance, protect, and conserve the County's land, air, and water resources, while establishing programs to generate awareness of and support for these measures.

GOAL 5-1: Implement resource protection, conservation, and preservation strategies that promote high water quality and protect aquatic life throughout Queen Anne's County.

STRATEGY 1: Implement watershed-based planning efforts to advance achievement of WIP and MS4 goals.

RECOMMENDATIONS:

1. Develop and implement strategies to reduce pollutant loads on a watershed by watershed basis in accordance with WIP and MS4 goals.
2. Update existing impervious surface analyses Countywide, beginning with the Kent Island Urban Area.
3. Track and limit impervious surface percentages on a watershed basis, in accordance with established impervious surface thresholds.
4. Develop a stormwater outfall inspection program to monitor mapped outfalls throughout the County.

STRATEGY 2: Promote and facilitate the protection of Sensitive Areas.

RECOMMENDATIONS:

1. Support State programs for the protection of wetlands and contemplate a no net loss policy.
2. Continue to implement the County's wetland and stream buffer protection ordinances.
3. Support the implementation of the Forest Mitigation Plan and Accounting Procedure.
4. Consider establishing a no net loss of forest policy for the County.
5. Continue to implement the Chesapeake Bay Critical Area Program to minimize adverse effects of human activities on water quality and natural habitat and allow for development in a sensitive manner.
6. Investigate utilizing shoreline restoration as a future way to achieve MS4 restoration goals and address sea level rise vulnerability, particularly if dedicated funding sources become available.

GOAL 5-2: Implement conservation, preservation, and regulation strategies including environmental protection and resource conservation measures.

STRATEGY 1: Develop steps to improve water quality with the goal of removal from the State's impaired waterway list.

RECOMMENDATIONS:

1. Manage the County's water resources in accordance with the adopted *Comprehensive Water and Sewerage Plan* and the *Water Resources Element* (see **Appendix D**).
2. Seek grant opportunities for stormwater management retrofits.
3. Meet the goals outlined in the Watershed Implementation Plan.

STRATEGY 2: Protect Sensitive Areas.

RECOMMENDATIONS:

1. To accommodate storm surges, nuisance flooding, rising sea levels, and climate change, prevent development in mapped flood zones and evaluate the appropriateness of going beyond FEMA requirements to consider additional restrictions based on projected sea level rise.
2. During new development project review, contemplate the *2016 Sea Level Rise and Coastal Vulnerability Assessment Plan*, which identified key vulnerable resources.
3. Finalize the *2019 County Climate Resilience Planning and Financing Study* and contemplate the prioritization of resiliency projects and capital improvements.
4. Implement aggressive efforts to reduce sediment, nutrient, and pollution delivery to flowing streams and the Chesapeake Bay by employing Environmental Site Design (ESD) techniques and meeting MS4/NPDES requirements.

GOAL 5-3: Implement a growth management strategy to direct new and infill development to existing County and Town Growth Areas.

STRATEGY 1: Meet growth management goals and objectives with respect to public water supplies and facilities.

RECOMMENDATIONS:

1. Require the development and use of Water Supply Capacity Management Plans for each community water system to support new allocations or connections to the system and to prevent capacity over allocation.
2. Establish watershed or wellhead protection strategies for water supply sources.
3. Establish water service areas in the County's Comprehensive Water and Sewerage Plan consistent with the Land Use Element based upon ability of the water resource to support development based on population growth as well as development capacity analysis based upon zoning (i.e. make any necessary updates based upon changes to Growth Areas, Town annexations and Priority Funding Areas).
4. Develop a Water Protection Plan working collaboratively through inter-jurisdictional agreements between the County and the Towns for planning and implementation, including tracking water-level declines of groundwater resources; the need for additional observation wells placed across the County to measure impacts of pumpage for domestic use and irrigation; and continued monitoring and study to ensure an adequate supply of necessary water resources.
5. Implement the immediate and short-term recommendations contained in the Queen Anne's County Water Service Area Study for Queen Anne's County Sanitary District (2009). Refer to the study for more details.
6. Make upgrades to existing water treatment facilities for the Towns as identified in their respective comprehensive plans, such as arsenic removal at the Town of Centreville's Business Park water treatment plant to treat up to 1,440,000 gpd; increased water storage capacity near Queen Anne's County High School for up to 600,000 gallons; and consider the reuse of water within planned annexation areas around Centreville.
7. Implement water conservation policies, guidelines, and regulations.

STRATEGY 2: Meet growth management goals and objectives with respect to public and private wastewater facilities.

RECOMMENDATIONS:

1. Implement the recommendations contained in the County's *Comprehensive Water and Sewerage Plan* (2011 and subsequent amendments), including addressing on-lot septic system failures on Southern Kent Island and other areas of concern (e.g., Dominion & Marling Farms).
2. Update the County's *Comprehensive Water and Sewerage Plan* to be consistent with **PlanQAC's** changes to future land use and recommendations regarding sewer capacity limitations.
3. Use of innovative methods including Best Available Technology (BAT) for on-site treatment and disposal of wastewater to address public health concerns by reducing nitrogen discharge levels.
4. Continue compliance with state and federal requirements with respect to permitting and reaching nitrogen reduction standards (use of Enhanced Nutrient Reduction (ENR) technologies) for the purpose of contributing to maintaining acceptable levels of water quality.
5. Enhance coordination between the County and Municipalities to identify water and sewerage service areas to identify additional water infrastructure and supply development needed to serve expected growth, including rerating the Town of Centreville WWTP to treat up to 750,000 gpd or substantially improve treatment to treat up to 1,000,000 gpd; acquiring additional land for spray irrigation.
6. Develop a financing, operation and maintenance plan for water connections.

STRATEGY 3: Provide adequate treatment for the quality, volume, and rate of stormwater runoff.

RECOMMENDATIONS:

1. Continue to implement the County WIP, working collaboratively through inter-jurisdictional agreements between the County and the Towns.
2. Balance the impacts of land use patterns across all landscapes (i.e. natural, agricultural, rural residential, suburban, and town/village) by directing new development and infill development to existing County and Town Growth Areas or new Town Growth Areas.
3. Continue to implement and update as needed the County's stormwater management practices and procedures and Environmental Sensitive Design Manual practices and procedures.
4. Evaluate all designated Growth Areas to ensure they can receive development without exceeding recommended percentage thresholds of the watershed land area with impervious surfaces.
5. Assess development plans with respect to effectiveness to implement load reduction alternatives on non-point source pollutant loads applying Environmental Sensitive Design (ESD) standards.
6. Measure post-construction tributary assimilative capacities for impacted sub-watersheds.
7. Utilize open space and land preservation programs to provide water protection measures.
8. Review and modify existing zoning and development regulations to direct growth to designated County and Town Growth Areas (i.e. ensure adequacy of public facilities and evaluate other growth management tools, such as low impact development ordinance, household pollution reduction education programs, landscaping demonstration projects, and use of best management practices for road reconstructions).
9. Establish appropriate buffers, setbacks, and lot coverage/impervious surface regulations to protect water quality from impacts of development.
10. Work collaboratively with the Municipalities and surrounding Counties to adopt water resource protection strategies and regulations.

11. Partner with regional localities, non-governmental organizations, and others to target high value restoration opportunities and increase implementation efficiency.
12. Use information technology to strategically locate and install restoration projects that maximize results of the County's stormwater management efforts.
13. Direct growth within Priority Funding Areas (PFA) while managing or reducing the potential for development outside of the PFA to assure the ability to maintain assimilative capacity in the watershed.

NATIONAL WETLANDS INVENTORY (NWI)
Includes wetlands identified by the US Fish & Wildlife Service. Typically, these include wetlands 5+ acres in size. Additional wetlands may exist.














DNR WETLANDS
Wetlands identified by the Maryland Department of Natural Resources, which supplement NWI datasets.

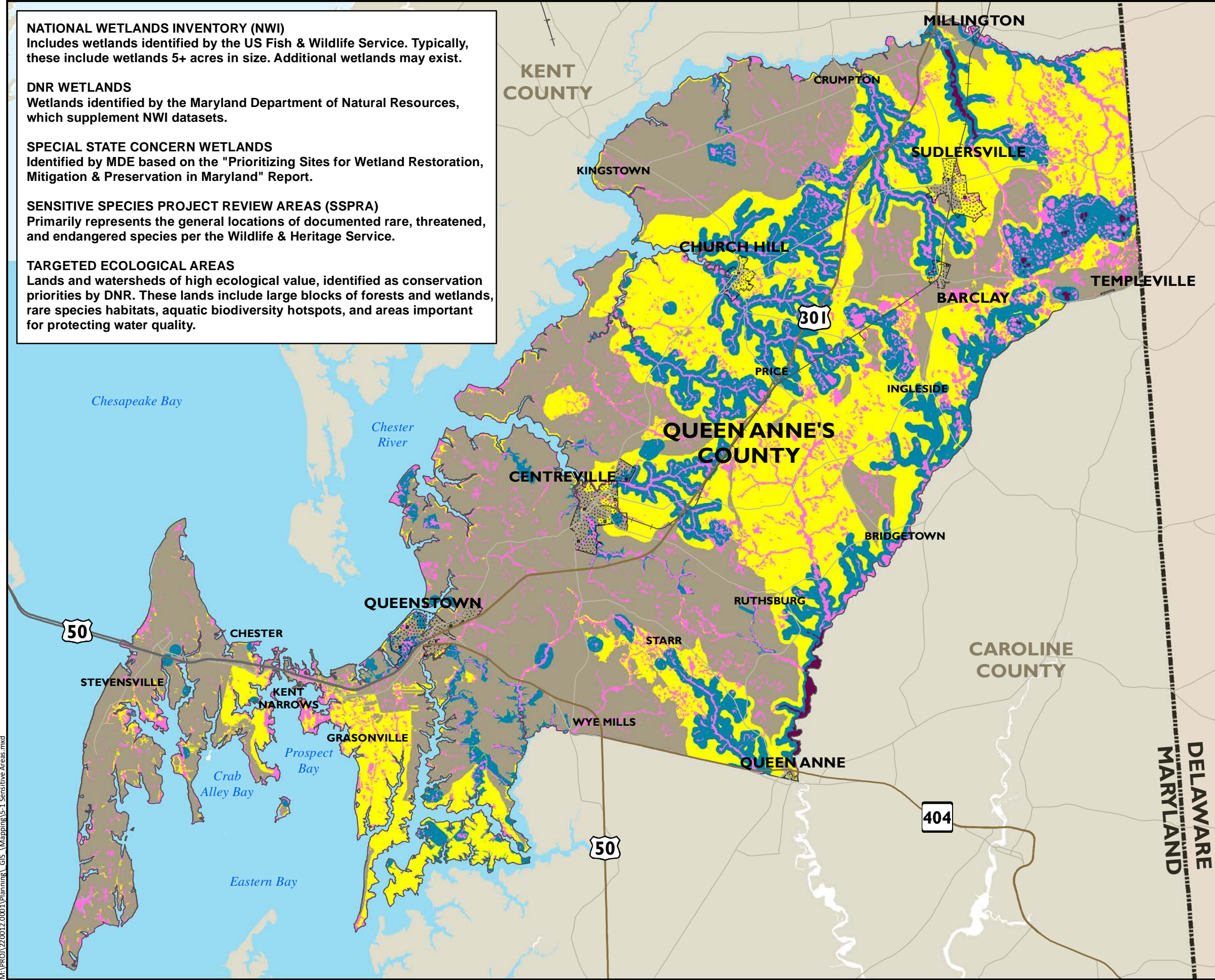
SPECIAL STATE CONCERN WETLANDS
Identified by MDE based on the "Prioritizing Sites for Wetland Restoration, Mitigation & Preservation in Maryland" Report.

SENSITIVE SPECIES PROJECT REVIEW AREAS (SSPRA)
Primarily represents the general locations of documented rare, threatened, and endangered species per the Wildlife & Heritage Service.

TARGETED ECOLOGICAL AREAS
Lands and watersheds of high ecological value, identified as conservation priorities by DNR. These lands include large blocks of forests and wetlands, rare species habitats, aquatic biodiversity hotspots, and areas important for protecting water quality.

MAP 5-1
Sensitive Areas

-  Queen Anne's County
-  State Boundary
-  Counties
-  Incorporated Towns
-  Water Bodies
-  Rail
- Major Roads**
 -  Interstates
 -  US Highways
 -  State Routes
- Ecological Areas**
 -  Special State Concern Wetlands
 -  NWI & DNR Wetlands
 -  Sensitive Species Review Areas
 -  Targeted Ecological Areas



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Source
MD iMap Special State Concern Wetlands,
Sensitive Species Review Areas, and Targeted
Ecological Areas

Wallace Montgomery created this map for planning purposes from a variety of sources. It is neither a survey nor a legal document. Information provided by other agencies should be verified with them where appropriate.

October 2021

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








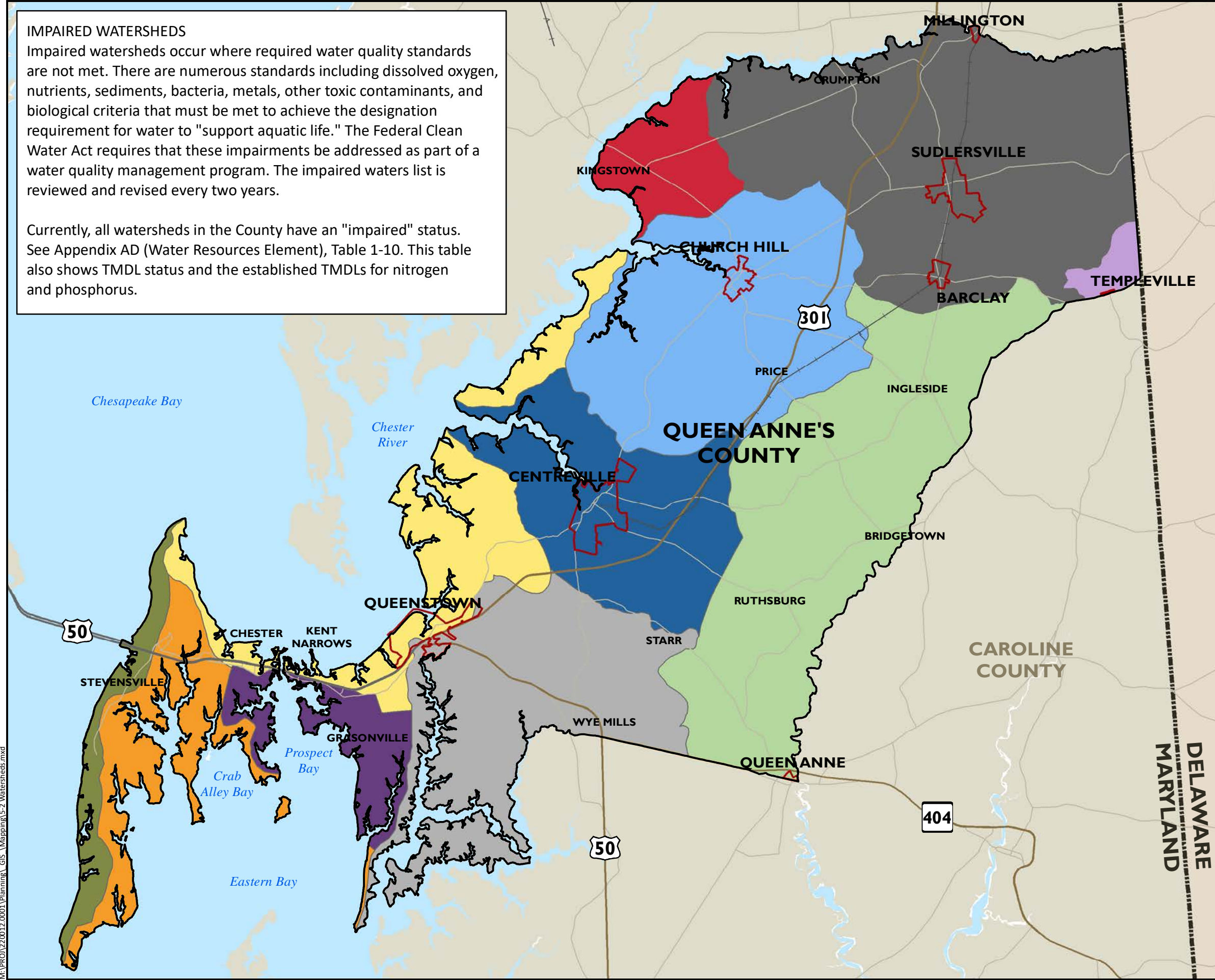
IMPAIRED WATERSHEDS

Impaired watersheds occur where required water quality standards are not met. There are numerous standards including dissolved oxygen, nutrients, sediments, bacteria, metals, other toxic contaminants, and biological criteria that must be met to achieve the designation requirement for water to "support aquatic life." The Federal Clean Water Act requires that these impairments be addressed as part of a water quality management program. The impaired waters list is reviewed and revised every two years.


Currently, all watersheds in the County have an "impaired" status. See Appendix AD (Water Resources Element), Table 1-10. This table also shows TMDL status and the established TMDLs for nitrogen and phosphorus.

**MAP 5-2
Watersheds**


-  Queen Anne's County
-  State Boundary
-  Counties
-  Incorporated Towns
-  Water Bodies
-  Rail
- Major Roads**
 -  Interstates
 -  US Highways
 -  State Routes
- 8-Digit Watersheds**
 -  Corsica River - 02130507
 -  Eastern Bay - 02130501
 -  Kent Island Bay - 02130511
 -  Kent Narrows - 02130504
 -  Lower Chester River - 02130505
 -  Middle Chester River - 02130509
 -  Southeast Creek - 02130508
 -  Tuckahoe Creek - 02130405
 -  Upper Chester River - 02130510
 -  Upper Choptank - 02130404
 -  Wye River - 02130503



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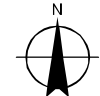
Source
MD iMap 8 Digit Watersheds



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October 2021

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NATIONAL WETLANDS INVENTORY (NWI)
Includes wetlands identified by the US Fish & Wildlife Service. Typically, these include wetlands 5+ acres in size. Additional wetlands may exist.

DNR WETLANDS
Wetlands identified by the Maryland Department of Natural Resources, which supplement NWI datasets.

IDA - INTENSELY DEVELOPED AREA
An area where residential, commercial, institutional, or industrial developed land uses predominate and where relatively little natural habitat is found.

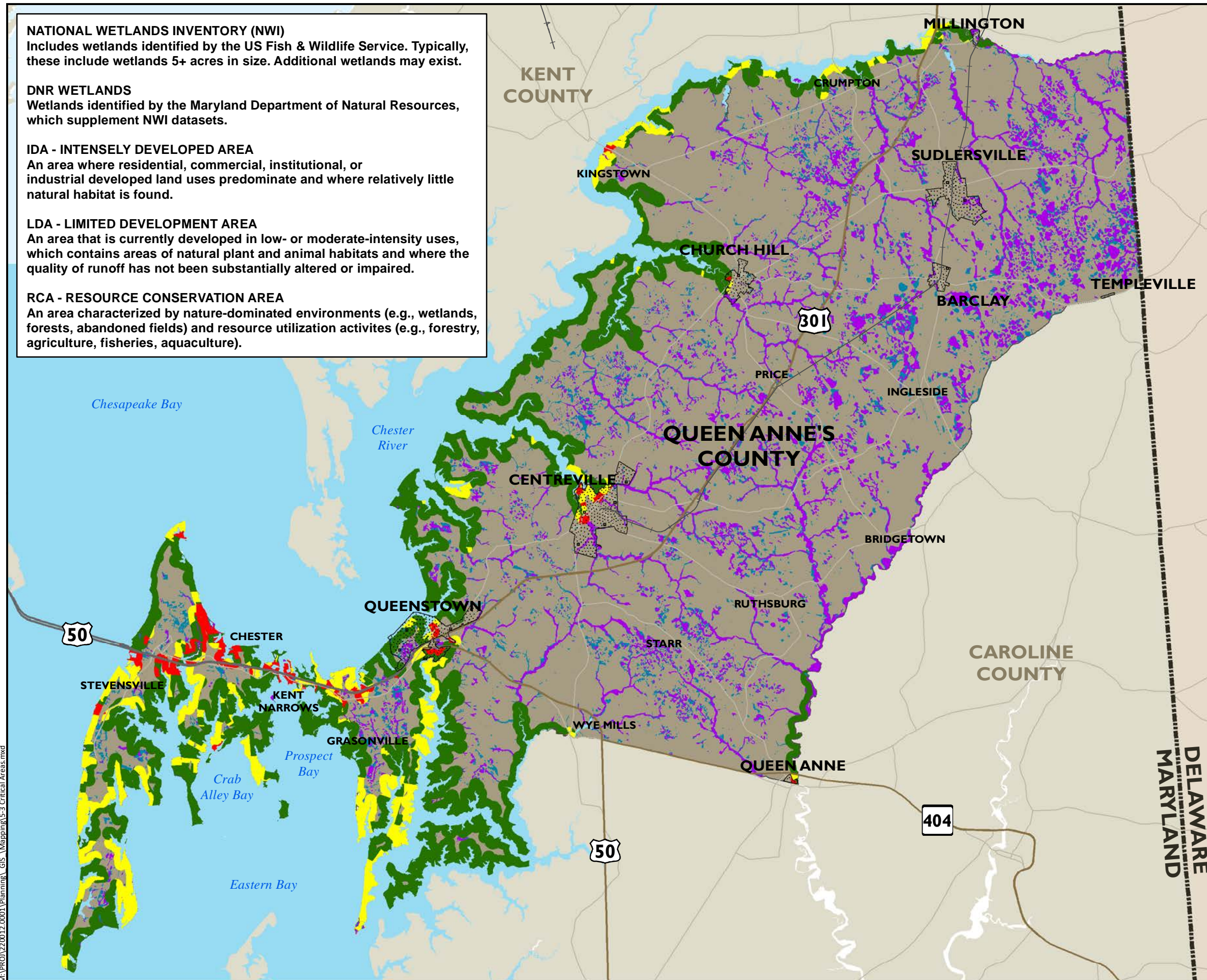
LDA - LIMITED DEVELOPMENT AREA
An area that is currently developed in low- or moderate-intensity uses, which contains areas of natural plant and animal habitats and where the quality of runoff has not been substantially altered or impaired.

RCA - RESOURCE CONSERVATION AREA
An area characterized by nature-dominated environments (e.g., wetlands, forests, abandoned fields) and resource utilization activities (e.g., forestry, agriculture, fisheries, aquaculture).

MAP 5-3

Chesapeake Bay Critical Areas

-  Queen Anne's County
-  State Boundary
-  Counties
-  Incorporated Towns
-  Water Bodies
-  Rail
- Major Roads**
 -  Interstates
 -  US Highways
 -  State Routes
- Environmental Features**
 -  National Wetlands Inventory Areas
 -  DNR Wetlands
- Critical Area Designations**
 -  IDA - Intensely Developed Area
 -  LDA - Limited Development Area
 -  RCA - Resource Conservation Area



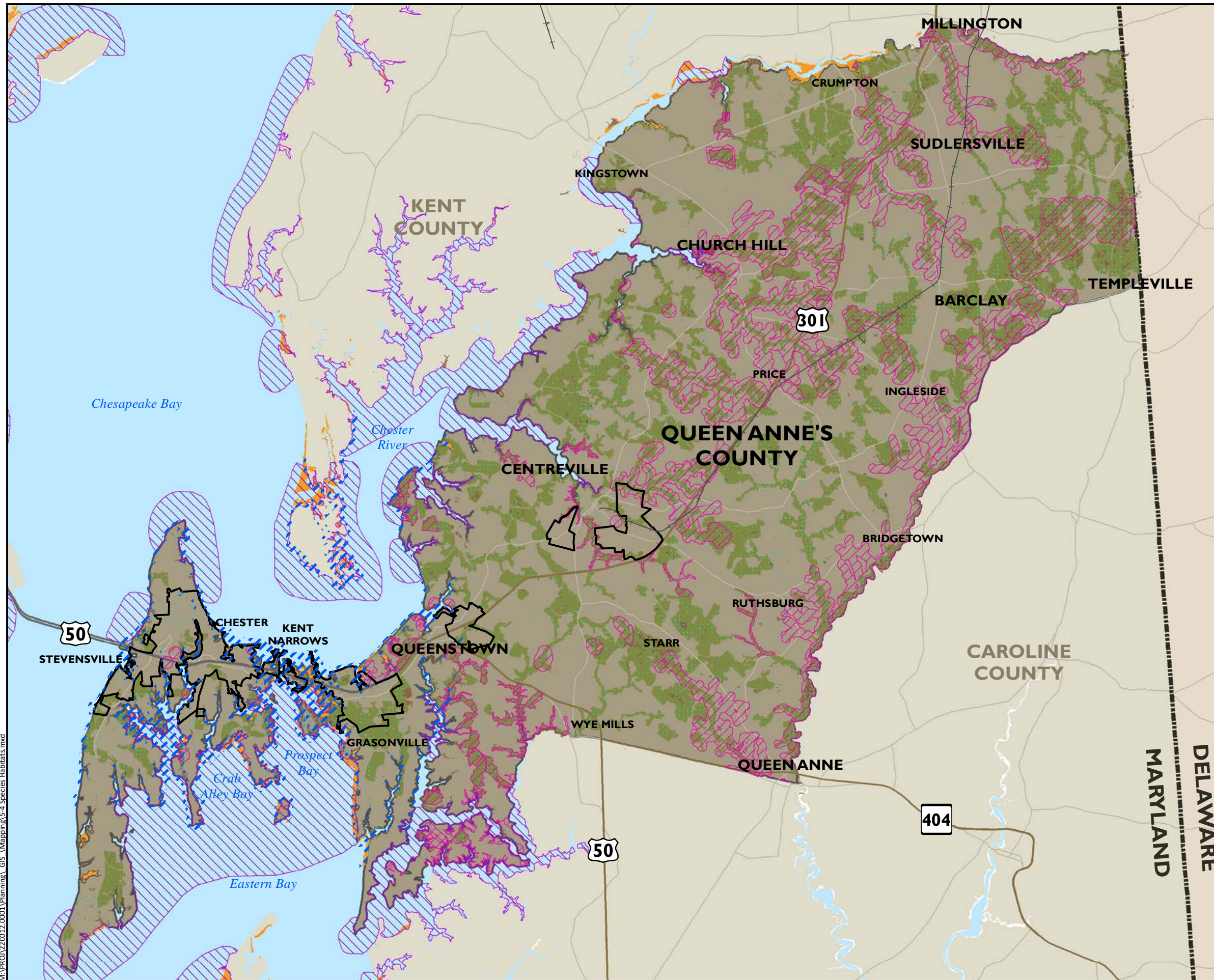
Source:
MD iMap Critical Areas
NWI Wetlands
DNR Wetlands

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October 2021

0 1.25 2.5 5 Miles





MAP 5-4 Species Habitats

- Queen Anne's County
- State Boundary
- Counties
- Growth Areas
- Water Bodies
- Rail
- Major Roads**
 - Interstates
 - US Highways
 - State Routes
- Natural Features & Habitats**
 - Wetlands
 - Floodplain
 - Waterfowl Staging Areas
 - Sensitive Species Review Areas
 - Marsh
 - Submerged Aquatic Vegetation
 - Forest Interior Dwelling Species

Source
 Queen Anne's County Planning Areas
 MD iMap Waterfowl Staging Areas, Submerged Aquatic Vegetation, and Sensitive Species Areas
 DNR Wetlands

Wallace Montgomery created this map for planning purposes from a variety of sources. It is neither a survey nor a legal document. Information provided by other agencies should be verified with them where appropriate.

October 2021

0 1.25 2.5 5 Miles

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SFHA-HIGH RISK AREAS

A Zone

Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.

AE Zone

Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses provided.

AO Zone

River or stream flood hazard area and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1-3 feet. Have a 26% chance of flooding over the life of a 30-year mortgage.

VE Zone

Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.

MODERATE RISK AREAS

X (Shaded) 0.2% or 500-Year Flood Zone
Moderate flood area(s), shaded area(s) shown on FIRM, are the areas between the limits of the base flood and the 0.2% annual chance (or 500-year) flood.


MINIMUM RISK AREAS


X (Unshaded) Flood Zone
The areas of minimal flood hazard, which are areas outside the SFHA and higher than the elevation of the 0.2% annual chance flood, are labeled Zone X (unshaded).

MAP 5-5

Flood Hazard Areas

- Queen Anne's County
- State Boundary
- Counties
- Water Bodies
- Rail
- Major Roads**
 - Interstates
 - US Highways
 - State Routes
- FEMA Floodplain Zones**
 - A
 - AE
 - AO
 - VE
 - X
 - Open Water
 - Area Not Included

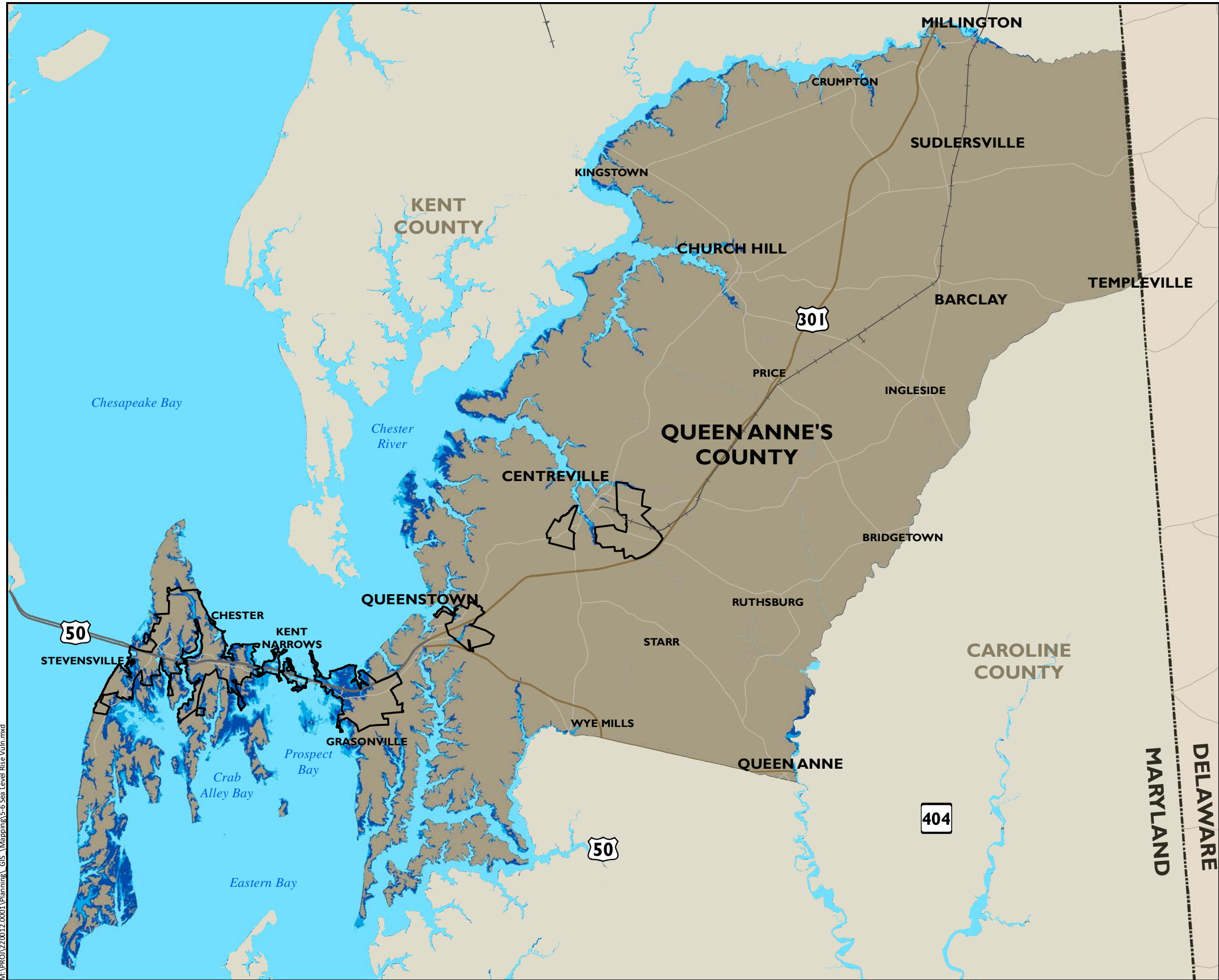

 Source
 Queen Anne's County
 MD iMap FEMA Floodplains
 DNR Wetlands


 Wallace Montgomery created this map for planning purposes from a variety of sources. It is neither a survey nor a legal document. Information provided by other agencies should be verified with them where appropriate.

October 2021
 0 1.25 2.5 5 Miles



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MAP 5-6

Sea Level Rise Vulnerability


- Queen Anne's County
- State Boundary
- Counties
- Growth Areas
- Water Bodies
- Rail
- Major Roads**
- Interstates
- US Highways
- State Routes

- Sea Level Rise Vulnerability**
- 0 to 2 Foot Inundation
- 2 to 5 Foot Inundation
- 5 to 10 Foot Inundation

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Source
Queen Anne's County
MD iMap Sea Level Rise Vulnerability

 Wallace Montgomery created this map for planning purposes from a variety of sources. It is neither a survey nor a legal document. Information provided by other agencies should be verified with them where appropriate.











October 2021
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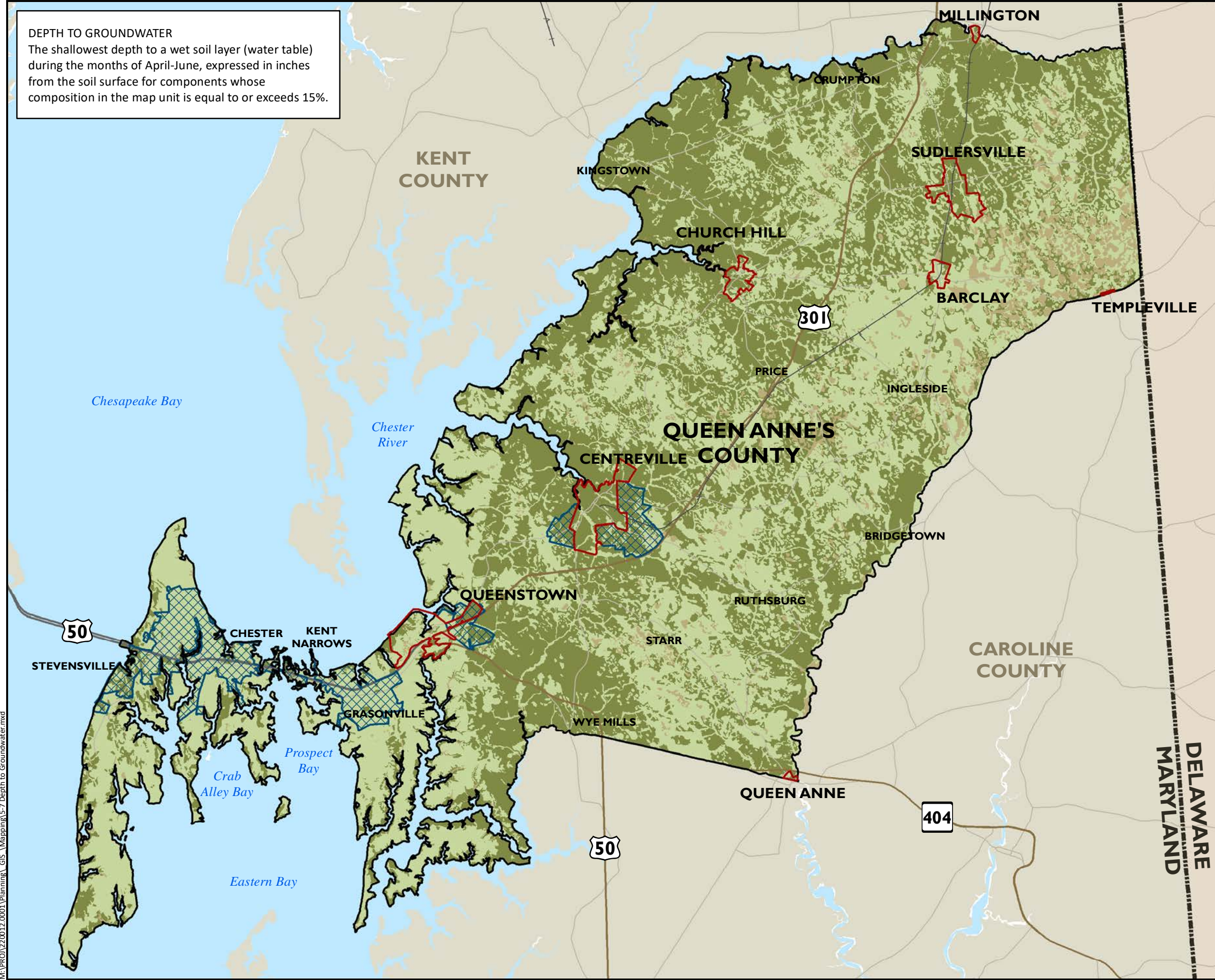
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DEPTH TO GROUNDWATER
 The shallowest depth to a wet soil layer (water table) during the months of April-June, expressed in inches from the soil surface for components whose composition in the map unit is equal to or exceeds 15%.


MAP 5-7
Depth to Groundwater


-  Queen Anne's County
-  State Boundary
-  Counties
-  Incorporated Towns
-  Growth Areas
-  Water Bodies
-  Rail
- Major Roads**
-  Interstates
-  US Highways
-  State Routes

- Depth to Groundwater (Inches)**
-  6" or Less
 -  6" - 30"
 -  Greater than 31"



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 **2021 COMPREHENSIVE PLAN**
 Source: MD iMap 8 Digit Watersheds and SSURGO Soils

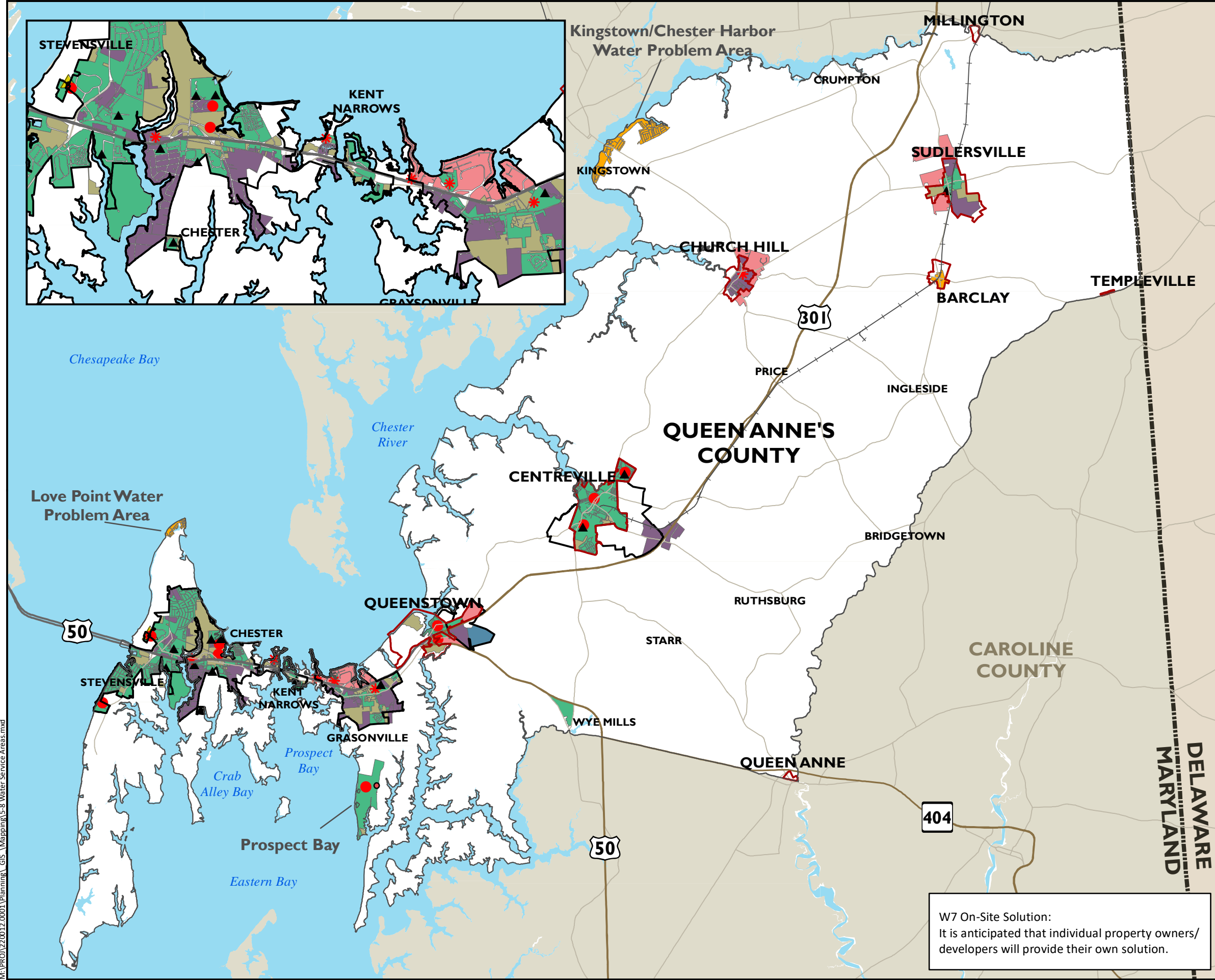
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October 2021

0 1.25 2.5 5 Miles



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MAP 5-8
Water Service Areas

- Queen Anne's County
- State Boundary
- Counties
- Incorporated Towns
- Growth Areas
- Water Bodies
- Rail
- Major Roads**
 - Interstates
 - US Highways
 - State Routes
- Water Facilities**
 - Private Water System
 - Proposed Water Treatment Plant
 - Well House
 - Water Tower
 - Water Treatment Plant
- Water Service Areas**
 - W1 Current Water Service
 - W2 1 to 3 years
 - W3 4 to 10 years
 - W4 11 to 20 years
 - W5 Beyond 20 years
 - W6 No Planned Service
 - W7 On-Site Solution

NOTE: For reference only. See latest Comprehensive Water & Sewer Plan for official maps.



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October 2021

0 1 2 4 Miles

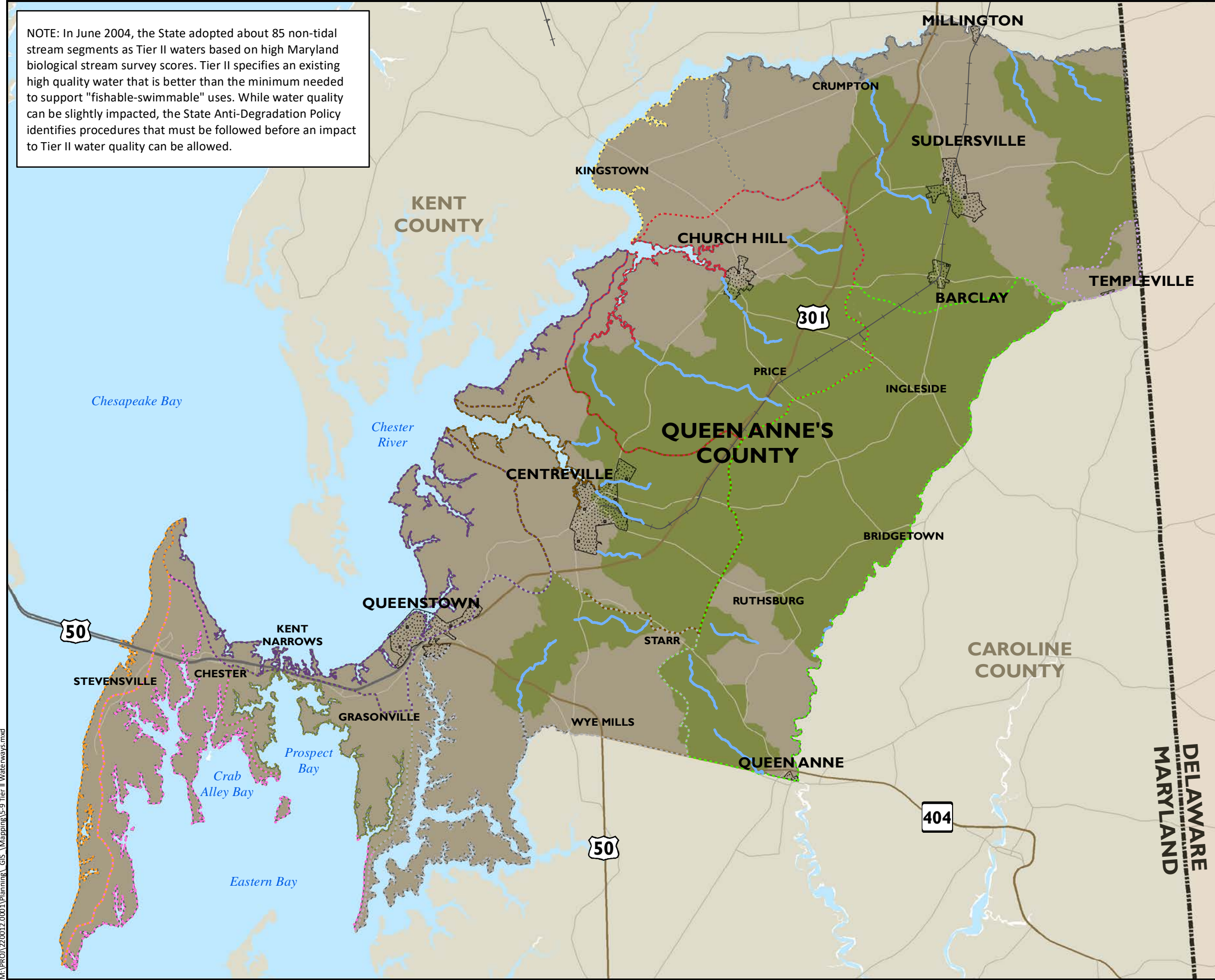
W7 On-Site Solution:
It is anticipated that individual property owners/developers will provide their own solution.

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NOTE: In June 2004, the State adopted about 85 non-tidal stream segments as Tier II waters based on high Maryland biological stream survey scores. Tier II specifies an existing high quality water that is better than the minimum needed to support "fishable-swimmable" uses. While water quality can be slightly impacted, the State Anti-Degradation Policy identifies procedures that must be followed before an impact to Tier II water quality can be allowed.

MAP 5-9 Tier II Waterways

- Queen Anne's County
- State Boundary
- Incorporated Towns
- Counties
- Rail
- Major Roads**
 - Interstates
 - US Highways
 - State Routes
- 8-Digit Watersheds**
 - Corsica River - 02130507
 - Eastern Bay - 02130501
 - Kent Island Bay - 02130511
 - Kent Narrows - 02130504
 - Lower Chester River - 02130505
 - Middle Chester River - 02130509
 - Southeast Creek - 02130508
 - Tuckahoe Creek - 02130405
 - Upper Chester River - 02130510
 - Upper Choptank - 02130404
 - Wye River - 02130503
- Waterways**
 - Water Bodies
 - Tier II Stream Segments
 - Tier II Catchments



Source
MD iMap MD Water Quality - Tier II Catchments and Tier II Stream Segments

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


















October 2021


0 1.25 2.5 5 Miles


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MAP 5-10

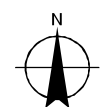
Sanitary Sewer Services

-  Queen Anne's County
-  State Boundary
-  Counties
-  Incorporated Towns
-  Water Bodies
-  Rail
- Major Roads**
 -  Interstates
 -  US Highways
 -  State Routes
- Sewer Plants and Stations**
 -  Collection Station
 -  Lagoon
 -  Lift Station
 -  Pump Station
 -  Private Sewer System
 -  Proposed WWTP
 -  WWTP
 -  Outfall Locations
- Sewer Service Area Designation**
 -  S1 Current Sewer Service Areas
 -  S2 1 to 3 Years
 -  S3 4- to 10 Years
 -  S4 11 to 20 Years
 -  S5 Beyond 20 Years
 -  S6 No Planned Service
 -  Effluent Spray Field

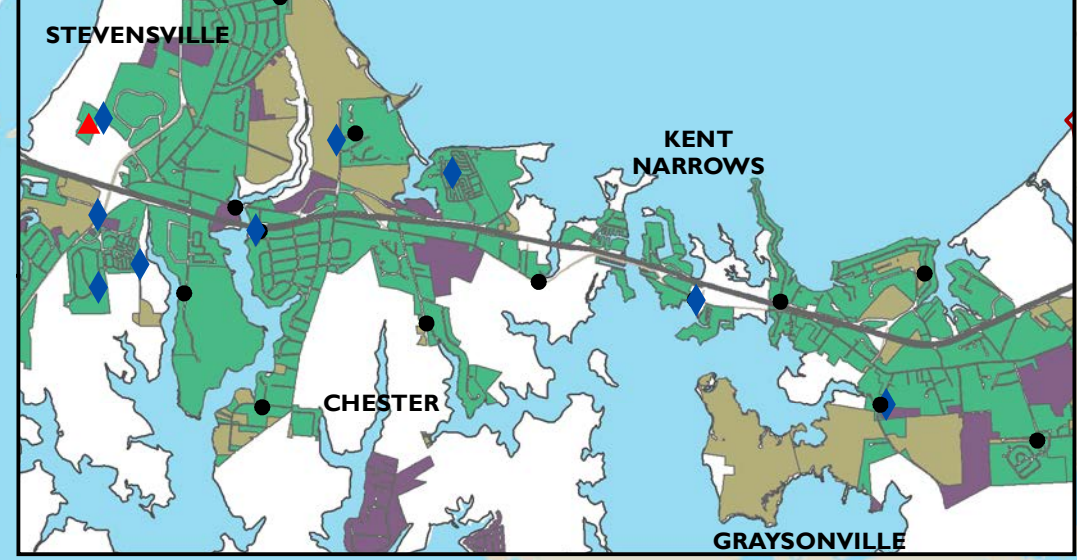
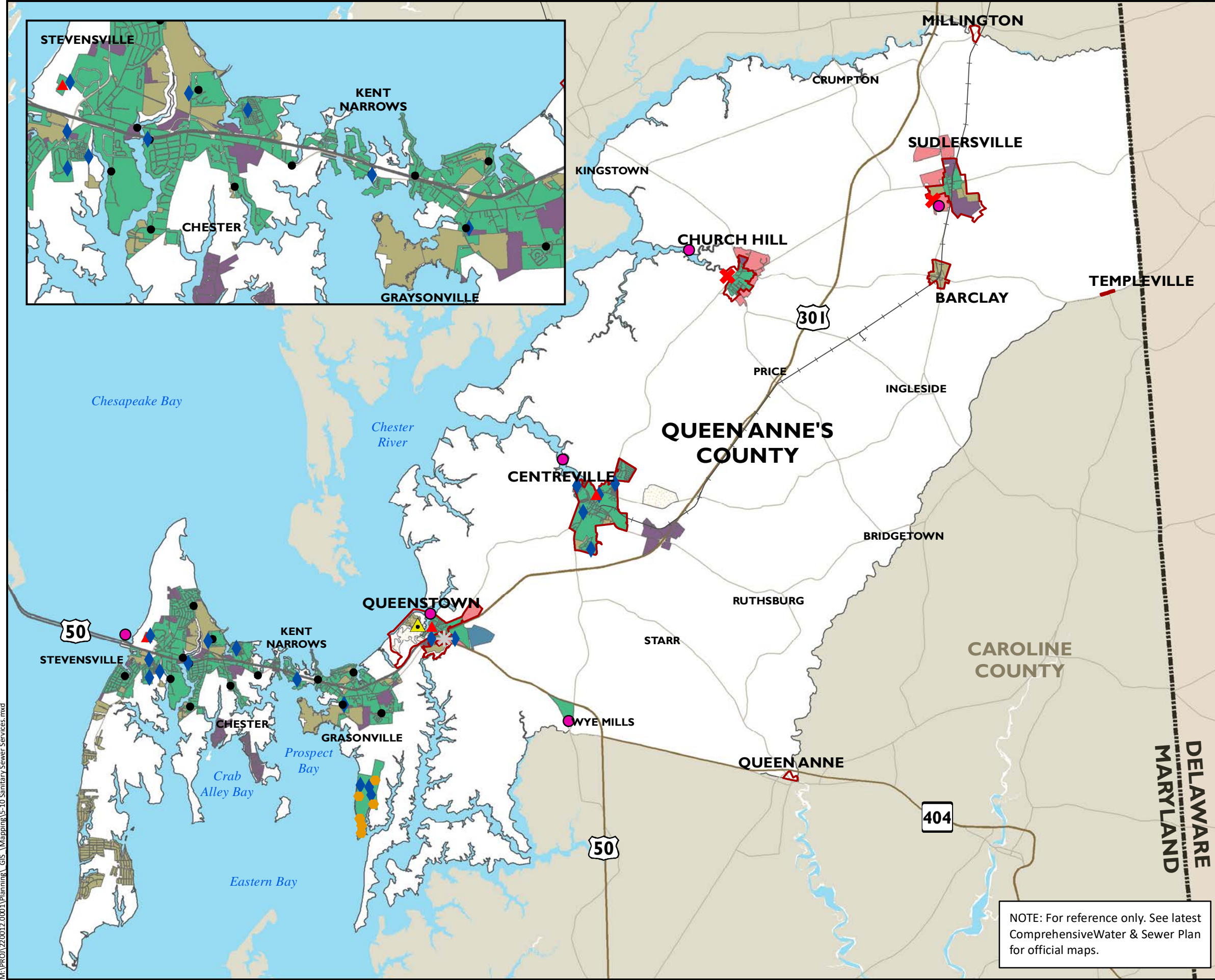
 **2021 Comprehensive Plan**
 Source: Queen Anne's County Sewer Facilities and Sewer Service Areas

 Wallace Montgomery created this map for planning purposes from a variety of sources. It is neither a survey nor a legal document. Information provided by other agencies should be verified with them where appropriate.

October 2021
 0 1.25 2.5 5 Miles



NOTE: For reference only. See latest Comprehensive Water & Sewer Plan for official maps.














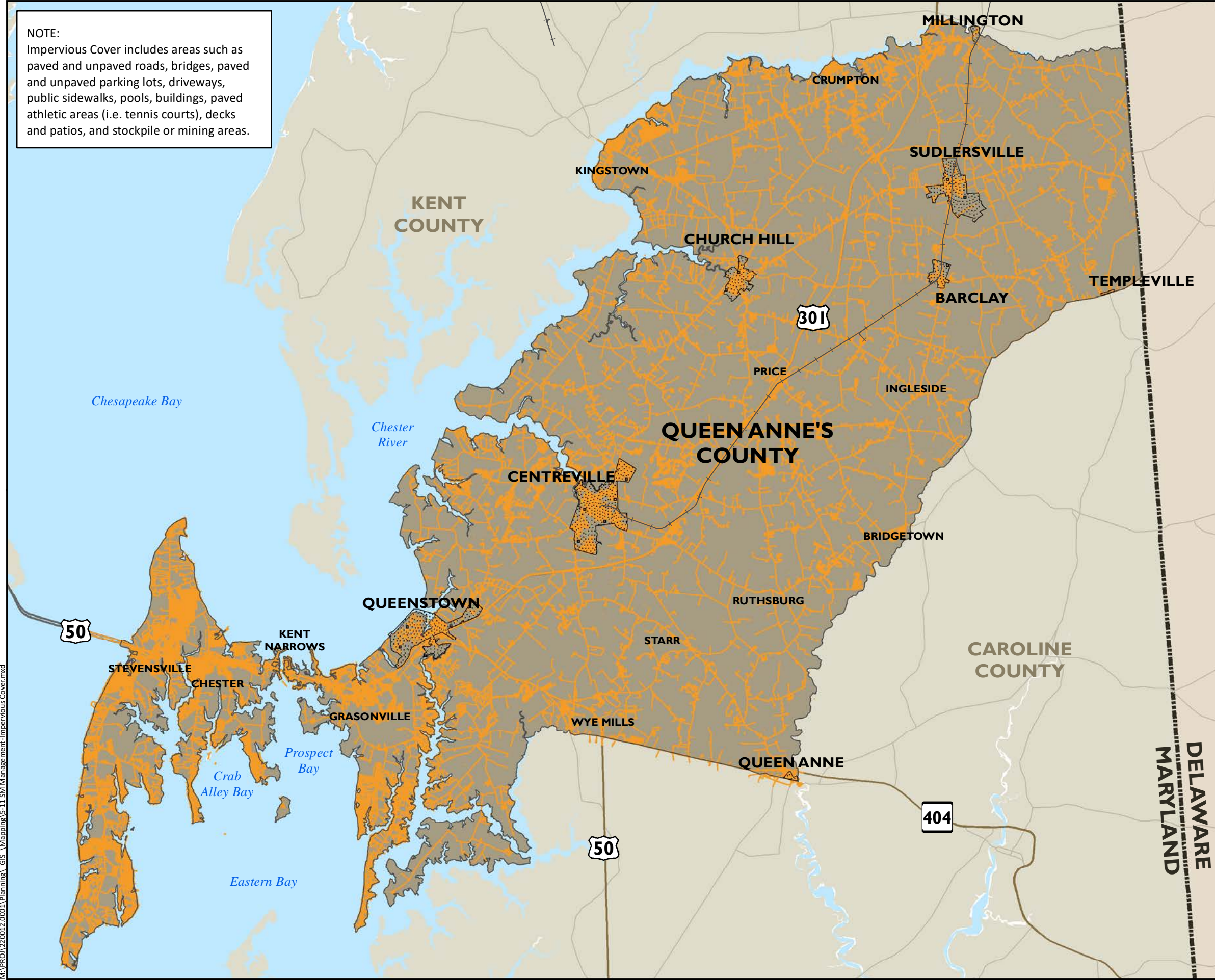
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NOTE:
 Impervious Cover includes areas such as paved and unpaved roads, bridges, paved and unpaved parking lots, driveways, public sidewalks, pools, buildings, paved athletic areas (i.e. tennis courts), decks and patios, and stockpile or mining areas.

MAP 5-11


Impervious Cover

-  Queen Anne's County
-  State Boundary
-  Counties
-  Incorporated Towns
-  Water Bodies
-  Rail
- Major Roads**
 -  Interstates
 -  US Highways
 -  State Routes
- Coverage**
 -  Impervious Cover (Including Roads)
 -  Pervious Cover



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 Source
 Queen Anne's County Impervious Cover














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October 2021
 0 1.25 2.5 5 Miles




MAP 5-12

Potential Mineral Recovery Areas


-  Queen Anne's County
 -  State Boundary
 -  Counties
 -  Incorporated Towns
 -  Water Bodies
 -  Rail
 - Major Roads**
 -  Interstates
 -  US Highways
 -  State Routes
 - Geology**
 -  Aquia Formation
 -  Tc Calvert Formation
 -  Qi Lowland Deposits
 -  Qu Upland Deposits (Eastern Shore)*
- *Areas of Potential Mineral Resources

NOTE: The information on this map should be used with great caution because sand and gravel deposits commonly change in thickness and composition over short distances and, in some cases, location is the determining factor as to whether a particular deposit can be used. Specific site investigations must be made before any actual reserve estimates or economic projections can be made.

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Source
USGS MD Geology



Wallace Montgomery created this map for planning purposes from a variety of sources. It is neither a survey nor a legal document. Information provided by other agencies should be verified with them where appropriate.

October 2021



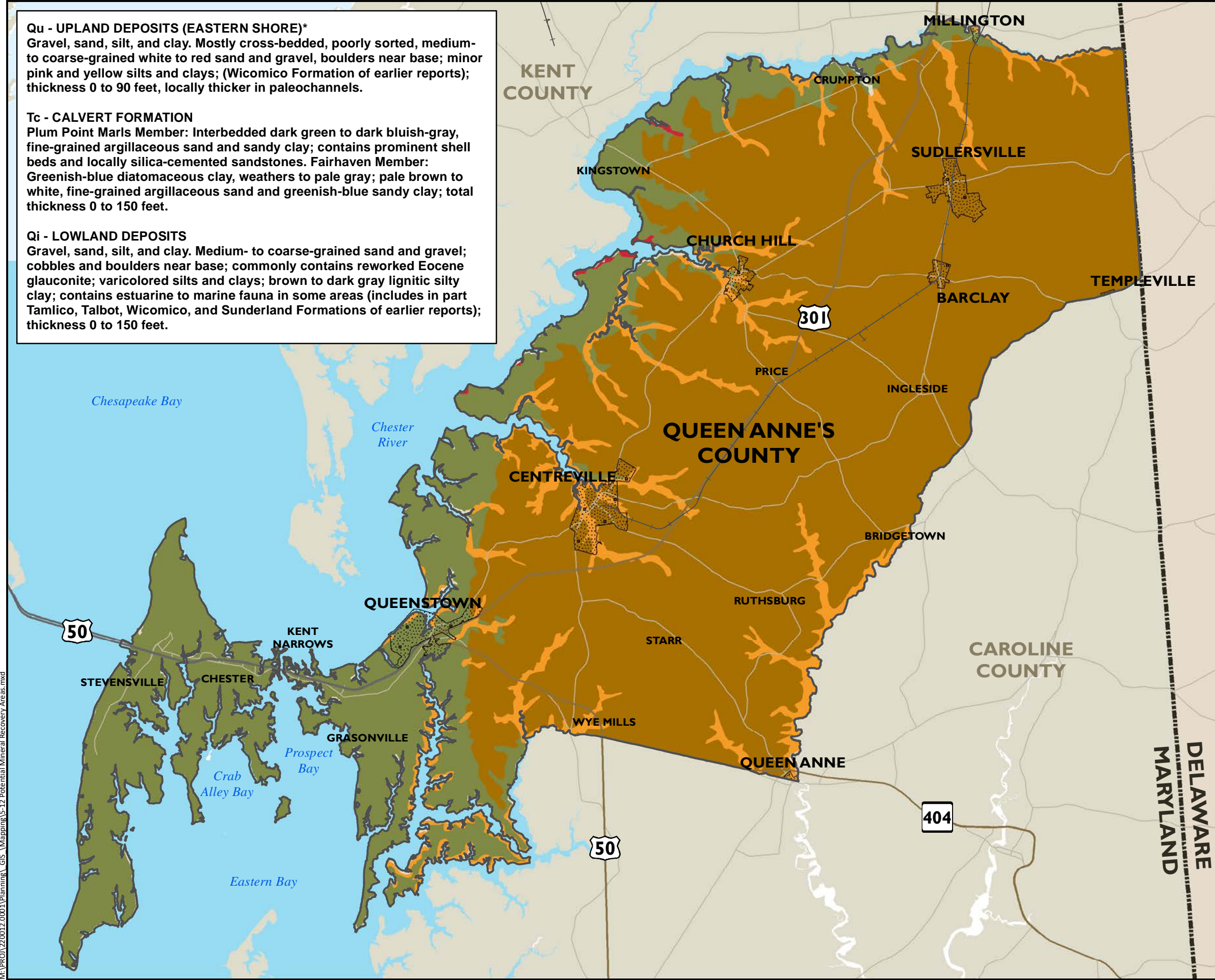
Miles



Qu - UPLAND DEPOSITS (EASTERN SHORE)*
Gravel, sand, silt, and clay. Mostly cross-bedded, poorly sorted, medium- to coarse-grained white to red sand and gravel, boulders near base; minor pink and yellow silts and clays; (Wicomico Formation of earlier reports); thickness 0 to 90 feet, locally thicker in paleochannels.

Tc - CALVERT FORMATION
Plum Point Marls Member: Interbedded dark green to dark bluish-gray, fine-grained argillaceous sand and sandy clay; contains prominent shell beds and locally silica-cemented sandstones. Fairhaven Member: Greenish-blue diatomaceous clay, weathers to pale gray; pale brown to white, fine-grained argillaceous sand and greenish-blue sandy clay; total thickness 0 to 150 feet.

Qi - LOWLAND DEPOSITS
Gravel, sand, silt, and clay. Medium- to coarse-grained sand and gravel; cobbles and boulders near base; commonly contains reworked Eocene glauconite; varicolored silts and clays; brown to dark gray lignitic silty clay; contains estuarine to marine fauna in some areas (includes in part Tamlico, Talbot, Wicomico, and Sunderland Formations of earlier reports); thickness 0 to 150 feet.



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