

## Section 5: Affected Environment

The National Environmental Policy Act (NEPA) requires that documents such as this special resource study and environmental impact statement include a description of the environment of the area affected by the alternatives under consideration. This description of existing environmental conditions is called the “Affected Environment.” It describes the natural, cultural, and socioeconomic environments of the Chesapeake Bay and its watershed in terms of resources that may experience or cause impact or be affected if one or more of the alternatives presented in Section 4 are implemented. A summary of the resources identified as “impact topics” associated with this project follows. An impact topic is defined as the resource discipline likely to be affected by a proposed action (e.g., aquatic resources, terrestrial resources, cultural resources, etc.). These impact topics and this section provide a basis for evaluating the potential effects of each alternative; this is presented in Section 6.

### NATURAL ENVIRONMENT Aquatic Resources

#### *Watershed*

The Chesapeake Bay watershed is a 64,000-square-mile drainage basin encompassing portions of six northeastern states (Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia) and the District of Columbia (see Figure 5-1). A vast number of rivers and tributaries and the region’s surface water runoff collect in the Chesapeake. The headwaters of the Susquehanna River, the largest Bay tributary, begin near Cooperstown, New York. The Bay proper is approximately 200 miles long, stretching from the mouth of the Susquehanna at Havre de Grace, Maryland, to Norfolk, Virginia. It varies in width from about 3.4 miles near Aberdeen, Maryland, to 35 miles at its widest point, near the mouth of the Potomac River. Including its tidal tributaries, the Bay has approximately 11,684 miles of shoreline (USGS, 2002a, b). Although the Bay lies totally within the Atlantic Coastal Plain, the watershed includes parts of the Piedmont and the Appalachian Provinces. The combination of waters from tributaries and the Atlantic Ocean provides a mixture of waters with a broad geochemical range (Grumet, 2000).

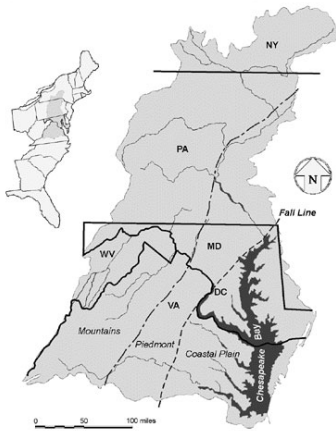


Figure 5-1: The Chesapeake Bay Watershed

#### *Streams and Rivers*

There are an estimated 111,000 miles of perennial and intermittent streams in the watershed (Matuszeski, 2000). There are more than 50 major rivers flowing through this region. Five rivers (Susquehanna, Potomac, Rappahannock, York, and James) provide 90 percent of the Bay’s freshwater volume. The largest, the Susquehanna, accounts for fully half of the freshwater discharged into the Chesapeake Bay.

#### *Estuarine Environment*

The Bay itself is an estuary—a place where fresh river water mixes with the salty Atlantic Ocean currents. It is the largest estuary in the United States and

one of the largest in the world. The sheer volume of freshwater that flows into the Bay makes its salinity, on average, 10 percent less than the water in the nearby Atlantic Ocean. The Bay was formed at the end of the last Ice Age, when melting glaciers caused sea levels to rise worldwide. Its deepest portions trace what in ancient times was the path of the Susquehanna River; its shallower parts were formed when land was flooded by rising ocean waters. Deeper waters are home to many species of fish, shellfish, and, on occasion, visiting ocean fish and aquatic mammals. Vast meadows of submerged aquatic vegetation, great banks of clams and oysters, sizable populations of blue crabs, young fish not ready for the open water, migratory waterfowl, clouds of diatoms, dinoflagellates, and other plankton also reside in the Chesapeake Bay (NPS, 1999; Grumet, 2000).

### ***Fish***

The fish in the Bay region fall into two categories: resident and migratory. Of the 295 species of fish known to inhabit the Chesapeake Bay region, 32 species are year-round residents of the Bay. Resident fish tend to be smaller than migratory species and often occur in shallow waters, where they feed on a variety of invertebrates. The resident Bay anchovy, for example, is the most abundant fish in the Bay waters and consequently forms a critical link in the food web because it serves as the dietary basis for many other species, including some species of birds and mammals. In the winter, it remains in the deep waters of the Bay, but, in the warmer seasons, it clings to shoreline areas, swimming in schools and feeding on zooplankton. The Bay anchovy spawns at night from April through September in warm areas of the estuary, where the temperature is above 54 degrees Fahrenheit (Chesapeake Bay Program Office, 2002a).

Migratory fish fall into two categories: catadromous or anadromous. Catadromous fish live in freshwater, but travel to the high-salinity ocean waters to spawn. The only catadromous species in the Bay ecosystem is the American eel, or *Anguilla rostrata*, which leaves its habitat in the Bay to spawn in the Sargasso Sea. Anadromous fish (fish whose incubation and juvenile state is in freshwater, maturation state is at sea, and later as adult, migrate into rivers for reproduction) such as the American shad and the blueback herring, travel from the high salinity waters of the lower Bay or Atlantic Ocean to spawn in the Bay watershed's freshwater rivers and streams. Other anadromous fish travel shorter distances to spawn and occupy a narrower range of salinities. For example, white perch journey from the middle Bay, which is not as salty as the ocean, to freshwater areas of the upper Bay and tributaries to spawn (Chesapeake Bay Program Office, 2002a).

### ***Shallow Water and Littoral Zones***

The shallow water, or littoral zone, is a unique habitat found at the edge of the shoreline. These waters continuously shift with the tides and thus undergo extreme environmental fluctuations throughout the year. In the summer, the waters become very hot with little moderation in temperature. In winter, ice often covers the water, making these zones much cooler than deeper areas. Shallow waters are constantly being affected by climatic change, in the form of wind and storms, which suspend sediments throughout the water column. Spring rains lead to the runoff of sediment and

nutrients from the land, which clouds the shallow waters even more. These heavy rainstorms also constantly change the salinity of the shallow waters.

### ***Aquatic Life***

A tremendous diversity of aquatic life inhabits shallow water environments. Rich plant communities that grow in the shallow waters, such as submerged aquatic vegetation and tidal marshes, provide key habitats for many invertebrates, fish, and waterfowl in various life stages. Shrimp, killifish, and juveniles of larger fish species use submerged aquatic vegetation, tidal marshes, and shallow shoreline margins as nursery areas and for refuge. Vulnerable shedding blue crabs also find protection in submerged aquatic vegetation beds. Predators (including blue crabs, spot, striped bass, waterfowl, colonial waterbirds, and raptors) forage for food here. Nearly 30 species of waterfowl visit the Bay during the winter (Grumet, 2000). Along the shoreline, fallen trees and limbs also give cover to small aquatic animals. Even unvegetated areas, exposed at low tide, are productive feeding areas. Microscopic plants cycle nutrients and are fed upon by crabs and fish.

### ***Wetlands***

Only 4 percent (1.6 million acres) of the 64,000-square-mile watershed is wetlands (Chesapeake Bay Program Office, 2002b). Two types of wetlands are present in the watershed: tidal estuarine (flooded by salty or brackish water) and palustrine (freshwater) wetlands. Most of the wetlands in the Bay are tidal. The Bay wetlands provide particularly crucial habitat for fish, shellfish, various waterfowl, shorebirds, wading birds, and several mammals. Striped bass, menhaden, flounder, oysters, and blue crabs are among the most commercially important fish and shellfish that depend on estuarine wetlands.

An important component of the Chesapeake Bay wetland ecosystem is submerged aquatic vegetation (SAV) – vascular plants that grow entirely under water. SAV provides habitat and food for fish, waterfowl, shellfish, and other invertebrates. Sixteen species of SAV are commonly found in the Chesapeake Bay or nearby rivers. Salinity is the primary factor affecting submerged aquatic vegetation distribution. Historically, 200,000 acres of Bay grasses grew along the shoreline; only 38,000 acres remained in 1984. The loss is due primarily to increased turbidity, which prevents light penetration to the plants, thus reducing photosynthesis; sedimentation that covers the plants; and increased nutrients in the water, which increases the algae population and also reduces light penetration (Chesapeake Bay Program Office, 2001a). The primary source of this loss is runoff from agriculture, new development, and industry. Because of restoration and conservation efforts in the Bay and the watershed, the area of SAV had increased to 85,000 acres by 2001 (USEPA, 2002).

## **Terrestrial Resources**

### ***Physiographic Provinces***

This region contains distinct, occasionally overlapping environmental areas often called physiographic provinces (Lower Coastal Plain, Upper Coastal Plain, Piedmont, Blue Ridge, Valley and Ridge, and Appalachian Plateau) (see Figure 5-2). The Bay watershed lies within the Coastal Plain and the

Piedmont Provinces. Each province is a unique and complex environment that both supports and is influenced by living things. The Bay environment consists of deep and shallow open saltwaters and the brackish waters of the lower tidal portions of rivers. Chesapeake Bay waters flow into the Atlantic Ocean near Norfolk at the Bay's southeastern end. This diverse landscape, with its varied topography and surface geology, has profound effects on the abundance and types of ecosystems throughout the watershed (USGS, 2002a).

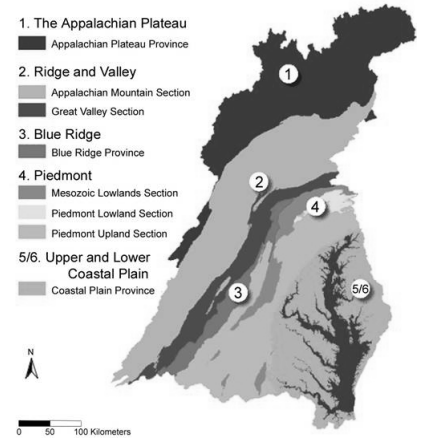
**Coastal Plain Province**

The Coastal Plain bordering on the Bay consists of beaches, marshes, forests, and grasslands growing on generally sandy or gravelly soils. This area is often divided into the Upper and Lower Coastal Plain. The Lower Coastal Plain is called the tidewater region because the waters coursing along its shore, rise and fall with the tide (see Figure 5-2). Coastal Plain sections on the Bay's eastern and southern shores generally tend to be flat and are drained by salty or brackish waters. Bluffs and low rolling hills drained by brackish or freshwater streams are located on the western shore and in the more interior parts of this region (Grumet, 2000).

*Coastal Plain Wildlife, Habitats, and Forest Communities*

The Coastal Plain consists of beaches, saltwater and brackish marshes, freshwater swamps, and forests. The region straddles an environmental borderland marking the southernmost extent of many northern species and the most northerly limits of many southern plants and animals. Tidewater beaches support distinct communities of shellfish, insects, and migratory birds. Plants that are resistant to salt spray, including salt grass, salt meadow cordgrass, and American holly, provide food and shelter to a wide variety of insects, mammals and birds and stabilize dunes and bluffs above the high tide mark, keeping them from eroding quickly into the Bay. Areas closest to the Bay are also home to low-lying salt marshes, which are flooded twice a day by the tides. Plant communities dominated by salt marsh cordgrass and other species able to withstand extended periods of immersion live in these areas. In contrast, areas of salt marsh that only are covered by water at high tide are dominated by salt meadow cordgrass and other less water-tolerant species. Just inland, common reeds, white perch, common snapping turtles, northern water snakes, great blue herons and other waterfowl, rice rats, and raccoons are among the many plants and animals making their homes in tidewater swamps and other brackish water wetlands (Grumet, 2000).

Further inland, freshwater marshes and swamps are home to bald cypress, red maple, green ash, sweet gum, loblolly pine, poison ivy, giant water bugs, north black racers, bullfrogs, eastern mud turtles, barred owls, wood ducks, marsh rabbits, Virginia opossums, muskrats, river otters, beavers, and many other species. In addition, the Upper Coastal Plain is populated by diverse mixed hardwood and softwood forests. Each community reflects variations in local weather, water, and soil conditions (Grumet, 2000).



Source: GIS lab/Smithsonian Environmental Research Center

**Figure 5-2: Physiographic Provinces of the Chesapeake Bay Watershed**

### ***Piedmont Province***

The Piedmont (literally “foot hills”) is a region of mixed hardwood forests and softwood barrenlands bordering on swift-running freshwater rivers and streams. Low mountain chains and isolated hills of hard rock, resistant to eroding power of these waters, rise above broad valleys covered by soft clay soils. A low-lying ridge chain, known as the fall line, runs through the region from Conowingo Falls on the Susquehanna River to Baltimore, Washington, and Richmond. The fall line separates the Piedmont uplands from the tidal lowlands of the Coastal Plain. Rapids flowing over this ridgeline mark the uppermost limits of navigation for ships sailing up the region's rivers. These distances vary from less than five miles on the Susquehanna River to well over 100 miles on the James River (Grumet, 2000).

In the Chesapeake Bay watershed, wildlife, fish, and plant life compete for land and water resources with approximately 15 million people. Forests originally covered as much as 95 percent of the Chesapeake Bay watershed. By 1900, though, less than 50 percent of the watershed was forested. Currently, about 41.25 million acres, or about 59 percent of the watershed, are forested (Chesapeake Bay Program Office, 2001b). Population growth and development constantly threaten the watershed's forests (USGS, 2000a).

### ***Piedmont Wildlife, Habitats, and Forest Communities***

Species most commonly found in southern softwood forests blend in with plants that flourish in more northerly mixed softwood-hardwood forests. Mountain laurel, ferns, and grasses flourish on Piedmont forest floors. Poison ivy, Virginia creeper, and other epiphytic clinging vines wind their ways around tree trunks that push their roots deep into the Piedmont's clayey soils. Low mountain chains and isolated hills of hard rock resistant to the eroding power of these waters rise above broad valleys covered by these soft clay soils.

White oaks, beeches, hickories, tulip trees, and, until decimated by blight, chestnuts dominate mature mesosere forest communities. Red oaks prosper in northerly parts of the region; black oaks tend to be more common in southern sections. American hornbeam, flowering dogwood, blueberries, shadbush, and maple leaf viburnum live in lower forest canopies. A wide variety of insects, amphibians, reptiles, birds, and mammals also make their homes in these forests (Grumet, 2000).

Chestnut oak, red oak, flowering dogwood, dwarf chinquapin oak, and Virginia pine are the dominant trees in dry xerosere forests. Blackjack oak and, more rarely, arborvitae, are found in extremely dry Piedmont barren lands. Blueberries, mountain laurel, and a variety of shrubs and grasses grow in upland xeric habitats. A relatively small number of animal species adapted to drier and harsher conditions make their homes in this zone (Grumet, 2000).

### ***Riparian Forest***

Areas of forested land adjacent to a body of water, stream, river, marsh, or shoreline, which form the transition between the aquatic and the terrestrial environment are referred to as riparian forest. The interconnected streams, rivers, wetlands, and their riparian areas serve as a "circulatory system" for

the Chesapeake Bay. Forests are the natural riparian vegetation in the Bay region. Although they comprise only about 5 to 10 percent of the land in the watershed, riparian areas play an extremely important role in maintaining the health of the Bay (Chesapeake Bay Program Office, 2001c). In the Piedmont swamps and streams, silver maple, sycamore, bitternut hickory, swamp white oak, hornbeam, box elder, hackberry, sweet gum, green ash, river birch, and, formerly, the American elm dominate the forests. Pawpaw, poison ivy, wild grape, wild azalea, witch hazel, and spicebush thrive on the forest floors in this zone. In contrast to its other habitats, Piedmont wetlands support some of the largest communities of insects, crustaceans, mollusks, fish, amphibians, reptiles, birds, and mammals in the Chesapeake region (Grumet, 2000).

## Threatened, Endangered, and Rare Species and Natural Communities

There are approximately 40 federally-listed threatened or endangered species within the Chesapeake Bay watershed. These species depend on a variety of habitats, many of which are being lost or degraded from development. The species include the bald eagle, piping plover, bog turtle, loggerhead sea turtle, several tiger beetles, northeastern bulrush, and small whorled pogonia. In addition, there are several hundred state-listed species protected by Maryland, Virginia, Pennsylvania, New Jersey, New York, Delaware, and West Virginia.

The following table (Table 5-1) is a partial list of protected species found in the Chesapeake Bay watershed.

<b>Table 5-1 Partial List of Federally Listed Threatened and Endangered Species in the Chesapeake Bay Watershed</b>		
<b>Scientific Name</b>	<b>Common Name</b>	<b>Status</b>
<b>Plants</b>		
<i>Aeschynomene virginica</i>	Sensitive joint-vetch	Threatened
<i>Agalinis acuta</i>	Sandplain gerardia	Endangered
<i>Amaranthus pumilus</i>	Seabeach amaranth	Threatened
<i>Helonias bullata</i>	Swamp pink	Threatened
<i>Isotria medeoloides</i>	Small whorled pogonia	Threatened
<i>Oxypolis canbyi</i>	Canby's dropwort	Endangered
<i>Ptilimnium nodosum</i>	Harperella	Endangered
<i>Schwalbea americana</i>	Chaffseed	Endangered
<i>Scirpus ancistrochaetus</i>	Northeastern bulrush	Endangered
<b>Mollusks</b>		
<i>Alasmidonta heterodon</i>	Dwarf wedge mussel	Endangered
<b>Insects</b>		
<i>Cicindela dorsalis dorsalis</i>	Northeastern beach tiger beetle	Threatened
<i>Neonympha mitchellii</i>	Mitchell's satyr	Endangered
<i>Nicrophorus americanus</i>	American burying beetle	Endangered
<b>Fishes</b>		
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	Endangered
<i>Etheostoma sellare</i>	Maryland darter	Endangered
<b>Reptiles</b>		
<i>Caretta caretta</i>	Atlantic loggerhead turtle	Threatened
<i>Chelonia mydas</i>	Atlantic green turtle	Threatened
<i>Clemmys muhlenbergii</i>	Bog turtle	Threatened

<b>Table 5-1 Partial List of Federally Listed Threatened and Endangered Species in the Chesapeake Bay Watershed</b>		
<b>Scientific Name</b>	<b>Common Name</b>	<b>Status</b>
<i>Dermochelys coriacea</i>	Atlantic leatherback turtle	Endangered
<i>Eretmochelys imbricata</i>	Atlantic hawksbill turtle	Endangered
<i>Lepidochelys kempii</i>	Atlantic ridley turtle	Endangered
<b>Birds</b>		
<i>Charadrius melodus</i>	Piping plover	Threatened
<i>Haliaeetus leucocephalus</i>	Bald eagle	Threatened
<i>Numenius borealis</i>	Eskimo curlew	Endangered
<i>Sterna dougallii</i>	Roseate tern	Endangered
<b>Mammals</b>		
<i>Myotis sodalis</i>	Indiana bat	Endangered
<i>Sciurus niger cinereus</i>	Delmarva fox squirrel	Endangered

## Air Quality



**Figure 5-3: Principal NOx  
Airshed for the Chesapeake Bay**

The airshed for the Chesapeake Bay extends over a much larger area than the watershed. The nitrogen oxide (NOx) airshed covers approximately 420,000 square miles, approximately 6 times the size of the watershed (Figure 5-3). The airshed extends south to South Carolina, west into Indiana, and northwest and north into Ontario and Quebec, respectively.

Nitrogen oxides from air emissions are a major source of nutrients for the Chesapeake Bay (USEPA, 1999). Air quality is affected regionally by fossil-fueled power plants, factories, and motorized vehicles. Local air quality is influenced by emissions from power plants, factories, and vehicles, as well as small engines, agricultural practices, and construction activities. Industrial operations and vehicles are major sources of nitrogen oxides and volatile organic compounds. These react together in sunlight to form ozone, which can be a major pollutant in highly urbanized areas.

Air quality within the watershed boundaries is generally good; however, four areas have been designated as ozone non-attainment areas: metropolitan Washington, D.C.; Baltimore, Maryland; Kent and Queen Anne's counties in Maryland; and Lancaster County, Pennsylvania. The metropolitan Washington D.C. area includes Washington, D.C., the Virginia counties of Arlington, Fairfax, Prince William, Loudoun, and Stafford; the cities of Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park; and the Maryland counties of Charles, Prince George's, Calvert, Montgomery, and Frederick. The Baltimore area includes Baltimore City and the counties of Anne Arundel, Baltimore, Carroll, Harford, and Howard.

## CULTURAL ENVIRONMENT

Cultural resources for the purposes of this Environmental Impact Statement are characterized as historical context, historic properties, archeological resources, and ethnographic resources.

“Historic properties,” as defined by the implementing regulations of the National Historic Preservation Act (36 CFR 800), are defined as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places. This term includes artifacts, records, and the remains that are related to and located within such properties, as well as traditional and culturally significant Native American sites and historic landscapes. The term “eligible for inclusion in the National Register” includes both properties formally determined eligible and all other properties that meet National Register listing criteria.

Properties may be eligible for the National Register for contributions at the national, state, or local level. Ordinarily, properties achieving significance within the last 50 years are not considered eligible unless they are integral parts of historic districts or unless they are of exceptional importance; the most common types of properties less than 50 years old listed on the National Register are works of modern architecture or scientific facilities. Additionally, in order for a structure or building to be listed in the National Register, it must possess historic integrity of those features necessary to convey its significance (i.e., location, design, setting, workmanship, materials, feeling, and association - see National Register Bulletin #15, *How to Apply the National Register Criteria for Evaluation*).

The majority of information found in this section was compiled from a National Park Service publication titled *Bay, Plain, and Piedmont: A Landscape History of the Chesapeake Heartland from 1.3 Billion Years Ago to 2000* (Grumet, 2000) and the study team’s experience on similar projects in the Chesapeake Bay watershed.

### Historical Context

For untold millennia, humans have lived and died in the Chesapeake Bay region. Today, one of America’s densest concentrations of people lives here, side by side with thousands of plant and animal species.

#### ***Paleo-Indian Origins (16,000-8,000 B.C.)***

Neither scientific archaeologists nor native traditionalists have conclusively discovered the identity of the earliest inhabitants of the Chesapeake Bay region. However, some ancestors of modern Native Americans, known as Paleo-Indians, did enter North America across the Bering Sea during a time when many coastal shelves had been exposed by low sea levels (<http://www.chesapeakebay.net/info/hist2.cfm>). Generation after generation, they spread across the continent by gathering wild plant foods and hunting great Pleistocene mammals. Armed with stone projectiles hurled with a throwing stick, or "atlatl," they followed herds of elk, bison, mammoth, and mastodon into the Bay area roughly 11,500 years ago.

The Chesapeake Bay as we know it did not exist during Ice-Age times. Instead, it was part of a wide, flat coastal plain. The often-shifting channels of the ancestral Susquehanna, Potomac, Rappahannock, and James Rivers meandered widely, and the region became a place of shallow swamps, lagoons, and grasslands as the glaciers retreated. As part of this process, sea levels were rising and the current outline of the Bay began to develop about 9,900 years ago. Many plant and animal species were replaced during this environmental change and this very likely affected local human subsistence.

Most archaeologists divide this earliest human occupation of the Chesapeake region into three overlapping phases. Each is noted by distinctive styles of stone projectile points. The Early Paleo-Indian phase, from 11,500 to 10,400 years ago, is marked by Clovis points (named for the New Mexico site where they were first identified). Sites associated with the Middle Paleo-Indian phase, between 10,800 and 10,200 years ago, tend to contain both Clovis and other forms of fluted and unfluted, lance-like points. Dalton points, or small fluted and unfluted, side notched projectiles with deeply curved concave bases, are considered a key diagnostic marker for the Late Paleo-Indian phase, dating from 10,400 to 9,900 years ago.

### ***Hunters-Gatherers (8,000 B.C.-A.D. 1000)***

Beginning about 10,000 years ago with the start of Holocene climatic conditions, the Chesapeake region became increasingly warmer and drier. Between 5,000 and 3,000 years ago, the climate continued to moderate and the many estuaries of the region gradually widened to form the current outlines of the Bay. Archaeological evidence confirms that local populations began exploiting this new bay and its tributaries to a much greater degree than in the previous period. These changes were significant and altered the way of life across the region. Increasingly larger populations began using new types of tools, site locations, and subsistence patterns - ways better suited to life in the new mixed hardwood forests. This period of cultural adjustment from big-game hunting to mixed-resource use is known as the Archaic period in North American archeology.

Native American peoples apparently prospered in the Chesapeake Bay watershed area, but most especially during the latter phases of the Archaic period. These early peoples resourcefully exploited food sources found in the forests and streams during their semi-nomadic 'seasonal rounds.' Nuts and tubers were gathered and turkey, deer, small mammals, and fish were also harvested for food and clothing (<http://www.chesapeakebay.net/info/hist2.cfm>). Though winters were always hard, this hunter-gatherer way of life persisted successfully for centuries and by the Late Archaic phase, larger and more stable populations apparently diversified their subsistence base.

The following Woodland period marks the final phases of independent Native American development in the Bay area. In the early Woodland phase, from 2,700 and 2,300 years ago, many new influential technologies were developed in the region. Grit-tempered and cord-marked pottery were introduced from the north, copper beads came in from the northwest, and tubular slate smoking pipes marked the influence of Midwestern peoples. Many of these artifacts are either direct imports or local copies of artifacts

belonging to the Adena culture centered in the Ohio River Valley. During the Middle Woodland phase, dating from 2,300 to 1,000 years ago, there was apparently a significant drop in the numbers and types of diagnostic artifacts, perhaps indicating a drop in local populations

### ***Towns and Villages (A.D. 1000-1500)***

While it appears that informal agriculture began along the Atlantic seaboard by 1000 B.C., it took until 600 to 900 A.D. before corn, beans, and squash were established as foundation crops across the Chesapeake's Piedmont and Coastal Plain Provinces (<http://www.chesapeakebay.net/info/hist2.cfm>). In addition, the bow and arrow were introduced approximately 1,000 years ago. Along with the activity surrounding the storage of food supplies against a winter's deprivation, people started to spend part of the year living together in formal villages. Some of these were also palisaded, or fortified, with a defensive boundary of saplings set in the ground in postholes.

In the Coastal Plain, most towns consisted of collections of structures that seem to have been irregularly placed, more 'organic' than 'formal' in layout. Piedmont towns, on the other hand, were more often 'planned' communities, laid out in a circle around an open plaza area, and very similar to the larger towns of the Mississippian cultures of the Midwest and South. These fortifications mark the beginnings of political competition and formal warfare, and indicate the social maturation and economic diversification of local Native American cultures.

These developments took place during the Late Woodland phase, from 1,100 to 500 years ago, and mark major changes over the preceding Middle Woodland times. Foremost, it appears that significant numbers of people were living in the Chesapeake Bay area, but most of these were beginning to congregate into larger villages located along major tributaries at the centers of major resource zones. Native Americans also began to harvest many of the Bay's signature species, including migratory waterfowl, shellfish, and anadromous fish, such as shad and herring.

### ***European Colonization (A.D. 1500-1775)***

European contact began with Spanish and French explorers in the early and middle 1500s. The English were relative late-comers to the Chesapeake. Starting about 1560, the Spanish adventurers had substantial and repeated altercations with Chesapeake Native Americans. The Spaniards took a young boy to Europe where he became a Catholic and was renamed Don Luis de Velasco. He was returned to his tribe when they established a Jesuit mission, probably on the York River, in 1570. Native Americans exterminated the Jesuits, except for one Spanish boy, who was eventually liberated, but not without the killing or capture of more Native Americans.

The "planting" of a successful Virginia colony came still more than two decades later when Capt. Christopher Newport and his fleet of adventurers sailed under the lee of what they named Cape Henry in April 1607. John Smith was aboard, but confined under accusation of political intrigue. It was only when sealed orders from the Virginia Company were opened upon their arrival, Smith was found and named as one of the ruling council. While it took until June 1607 for them to grudgingly admit him to the council, his

remarkable adventures as explorer, soldier, cartographer and "sometime Gouverneur" in the New World had begun.

The population around the Bay in 1607 was perhaps 25,000 or 30,000, and there may have been a total of some 100,000 or so spread over the basin's 64,000 square miles (<http://www.chesapeakebay.net/info/hist2.cfm>).

Native Americans were legitimately concerned about these unwashed Europeans and their great white winged "canoes." The Powhatan confederation of chiefdoms, dominant around the lower Western Shore, already knew these interlopers were a present danger to their way of life. Some archaeologists believe that diseases carried by the Europeans on the earliest visits to the Chesapeake and the Carolinas spread and killed large segments of the Native American population.

In 1607, the English "seated" their plantation at Jamestown, a marshy island some miles up the Chesapeake's third greatest river (behind Susquehanna and Potomac), and the closest one to the sea. They called this tributary "King James, His River." Some feel this island may have been the only land Powhatan would let them have. It was a good choice for the Native Americans, but, for the English, it was a disadvantage with marshy malarial ground and unhealthy brackish water.

The Calverts, wealthy English Roman Catholics, obtained a grant for a colony to be named Maryland from Charles II. George Calvert formed a London Company and, in 1634, planted his settlement near the mouth of the Potomac. This colony, and good relations with neighboring Piscataway tribes, provided a strong human foundation that eventually overcame a massive number of deaths from "the seasoning," and assured a permanent English presence on the Chesapeake.

The first disruptions to this Colonial agrarian economy and the Bay were triggered by political upheaval in Europe and failures in Continental tobacco markets. These events began in the late 17th Century and accelerated in the 18th century. The repercussions, compounded by English taxation of the Colonies, made Americans realize they would have to provide for themselves. Grain, particularly wheat, became an important crop. With grain came a technological innovation that would revolutionize the practice of Chesapeake agriculture, and forever change the face of this continent. It was the iron moldboard plow, which turns the soil rather than just breaking ground. The European ideal of "high farming" was touted by an increasing circulation of magazines and manuals: rectangular fields, straight furrows plowed by draft animals far stronger than men with hoes, and repeated deep tillage of the soil. Tillage was often straight downhill, with gravity assisting the animals' work. Subsequent rains coursed downhill as well.

Land in essentially permanent tillage broke the cycle of reforestation and tore up the natural fabric of the forest floor, a web of fungal, bacterial, and rooted plant species. The land ecosystem became "leaky" and vastly increased levels of nutrients leached from the soils and headed straight for the Bay and its food chain. For a while, it is likely that the Bay's living resources were stimulated, with the network of plants and animals actually "fed" by these inputs. Not being under heavy harvest pressure, fish and shellfish flourished.

Over the next 150 years this continuing excess of nutrients became the greatest pollution problem facing Chesapeake Bay.

Before 1776, only 21 percent of households in Charles County, Maryland, owned plows and just 2 percent of the land had been cleared. After 1776, 73 percent of landholders and tenants owned plows and exposed soils rose to 40% of the county's area. The result was soil erosion on a never-anticipated scale. As land all around the Coastal Plain was deforested and put under the plow, population pressure pushed agriculture up onto the Piedmont and, by the late 1700s, into the Appalachian valleys. The nation was expanding westward, and the Bay region's Native American world, with its stable agrarian economy, had all but disappeared.

The population of European colonists and African slaves around the Maryland Chesapeake Bay area went from 150 in 1640 to 34,000 in 1700. By 1740, it was 100,000, and by the Revolution in 1776, a quarter million. The United States was growing, but heavy mechanical plowing carried from the Coastal Plain onto steep, eroding piedmont soils was a disaster. Above the river fall-lines and in Pennsylvania, where settlement was also spreading west into the Chesapeake Basin from a growing Philadelphia, some farms lost all their topsoil in 25 years.

From the 1750s to the 1770s, ports for ocean going vessels all around the Bay were filled in by eroded sediments and became too shallow for navigation. Mattawoman Creek and the Port Tobacco River on the Potomac, Upper Marlboro on the Patuxent, Elkridge on the Patapsco, and Joppatown north of Baltimore were all lost.

The starvation and diseases of the early Colonial period were gone and, by 1750, because of good nutrition, Marylanders were in stature among the tallest people in the world. Emphasis on the land and agriculture meant a great deal of domestic meat was available and the pressure for seafood harvesting was actually reduced by 1750.

### ***Independence and Expansion (A.D. 1776-1825)***

The conclusion of the War for Independence between Great Britain and the United States significantly altered peoples' lives throughout the Chesapeake Bay. Although opinions about the war were divided, all people in the region suffered from shortages caused by the British blockade begun in 1776. However, the response to this blockade led to the development of many new types of sailing vessels and practices such as 'privateering' or officially sanctioned piracy. The Chesapeake Bay region, even today, maintains a rich naval history and shipbuilding and repair industry.

By 1812, St. Michaels was home to six shipyards and the birthplace of the famous, sleek Baltimore clippers. The clippers came into their own during the War of 1812 by skillfully evading the British blockade and roaming the Atlantic as privateers. They would not, however, prevent the burning of Norfolk and Washington, D.C., and the bombardment of Fort McHenry near Baltimore, an event that inspired Francis Scott Key to write "The Star-Spangled Banner."

The region's population grew from 700,000 in 1775 to more than 1.3 million by 1820 and commercial seaport towns like Annapolis, Norfolk, and Chestertown prospered as never before, and river communities like Alexandria and Petersburg attracted large numbers of French immigrants fleeing revolution and revolt in Europe. Free and enslaved African Americans, many of whom entered the nation from ships docking at Bay ports, made up a large percentage of the Bay's population, in the cities and on farms. Baltimore was home to the second-largest group of free blacks in the U.S. and many participated in the Bay's economy as oystermen, sailors, and tradespeople. In contrast, Native American populations were mostly limited to tiny rural enclaves in unwanted swamplands and pine barrens, and generally declined in numbers due to poverty and disease. Fewer than 500 Native Americans likely remained in the region by 1820.

### ***Industry and Urbanism (A.D. 1826-1950)***

The Chesapeake Bay region split into a free labor market in the north and a slave labor economy farther south. Waterways in the Bay region were used by slaves attempting escapes to freedom along the Underground Railroad. The region was devastated by the violence of the Civil war and many of the undisturbed landscapes were changed forever. Every level of government built fortifications, expanded and modernized navy yards, raised armies and established elaborate logistics networks.

In the latter part of the 19<sup>th</sup> century, industrial development continued on, while the Bay remained the source of industries centered on the extraction of natural resources. Over-extraction by commercial fisheries in the late nineteenth century led to the creation of fish hatcheries and limitations on extraction.

The region's population doubled from 2.5 million in 1880, to 5 million by 1930. Many of these people settled in established urban centers such as Baltimore, Washington, Richmond, and Norfolk. Important technological innovations fueled this massive rise in population. First, innovators increased the efficiency of earlier technologies based on wind, water, wood, and coal. Gas engines and electric motors replaced wind and other traditional power sources by the 1930s. Powered by steam boilers at the beginning of the period, ships, tractors, and a host of other contraptions and conveyances were propelled by internal combustion engines running on gasoline and diesel fuel at its end. Culturally, the heritage of centuries of slave-based economy led to 20<sup>th</sup> century issues of segregation and racial violence in the region, and ultimately to pioneering efforts in the modern Civil Rights Movement.

### ***Post 1950 and Bay Restoration***

Despite increasing environmental awareness and concern, the over-harvesting of the Bay resources threatened economically and ecologically important fish, shellfish, and wildfowl. With the passing of the Clean Water Act of 1972 and the establishment of the Chesapeake Bay Program in 1983, efforts to protect and restore the region's environment took shape. However, the growing population and increased strain on the natural environment have continued to affect the Bay.

## Archeological Resources

### *The Chesapeake Bay*

From the mysterious shipwreck lying off the tip of Tangier Island (possibly dating from the 16th century) to the Coast Guard cutter *Cuyahoga* that sank after slamming into a freighter in 1978, more than 1,800 different vessels have met their end in the Bay's waters (<http://www.chesapeakebay.net/info/shipwrck.cfm>).

Certain areas in the Bay are known for their treacherous shoals or exposure to dangerous storms. The area at the mouth of the Bay between Capes Henry and Charles is particularly infamous for its shifting sand bars: it is so well known, in fact, that it has earned a proper name, the Middle Ground.

During wars, calamities of battle heightened the usual hazards of ship travel. Many of the shipwrecks in the Bay were casualties of the Revolutionary War, the War of 1812, and the Civil War. Direct hits from cannons, explosives and torpedoes brought down many of the ships, but fires and collisions also played a role.

By the latter part of the 1800s, steamboats became a popular means of traveling around the Bay. These boats were vulnerable to the whims of hurricanes or nor'easter storms, especially if caught in the open Bay with no cover. In October 1878, a steamer on the Potomac Transportation Line named *Express* was working her way north in the main Bay channel when a storm struck with gale force winds. Unable to make safe harbor and with anchor chains snapped, the steamer felt the full brunt of the storm's swell. *Express* capsized, forcing her passengers to cling to bits of floating debris to save their lives. Lifeboats from another steamer driven aground that night rescued many of the victims, but 16 of the 31 on board lost their lives.

Marine archaeologists use whatever records may be available, including old news reports, to help locate wrecks of possible historic interest. The Calvert Marine Museum sponsored excavation of the remains of a ship in the Patuxent River known as the "Turtle Shell Wreck." The excavation team removed the sediment from the river bottom and found the well-preserved wreck and a variety of artifacts 4.5 feet below the surface. Information retrieved from the river bottom confirmed that the ship had belonged to the Chesapeake Flotilla, which was mobilized by Commander Joshua Barney against the British during the War of 1812.

Because the Chesapeake Bay is actually a drowned river valley, a significant portion of what is currently underwater was originally dry land. Many prehistoric archaeological sites likely remain intact along the bottom of the Bay, and along ancient river terraces. Underwater archaeology has only recently begun to assess these hidden resources with new recovery techniques and predictive locational models. In fact, the absence of so many early sites would be accounted for by the fact that archaeologists have been looking in the wrong place.

### ***The Chesapeake Plain***

A wide variety of archeological resources, however, nevertheless remains on dry land, and most especially on the broad coastal plain surrounding the Bay. As these lands were most often occupied by sedentary agriculturists, and given the fact that these people tended to aggregate into larger settlements with more material remains, the Tidewater areas of the Chesapeake are likely the richest source of archaeological resources. Unfortunately, these resources are also in the closest proximity to modern populations and the forces of development, and they remain most at risk in the region.

Scientists estimate there are at least 100,000 archeological sites scattered around the Bay with only a small percentage documented. Most are susceptible to a variety of destructive factors, both natural and manmade, which imperil their existence. With development consuming land around the Bay at a rapid pace, undocumented sites may be bulldozed before their valuable information comes to light. When farmers plow their fields, they can inadvertently destroy artifacts from a Native American tribe long gone. As sea level rises, as it has for many thousands of years, shoreline erosion will continue to destroy many sites. Minimal till practices limit the likelihood of artifact dislocation, while shoreline stabilization projects help protect sites from wave erosion.

Recorded history of the Bay area Native Americans began just prior to 1600 A.D. with the records kept by the newly-arrived European settlers. John Smith, who explored the Bay in 1608, found primarily Algonquian-speaking Native Americans inhabiting the shores. At the north end of the Bay lived the Susquehannocks, members of the feared Iroquois nation. Many distinct tribes with their own “wiroance,” or chief, lived around the Bay, but they often grouped into large confederations. The Powhatan Confederation in Virginia, is named for its leader (Pocohantas' father), and was one of the most powerful of the time. Despite their strength and savvy, however, the Native American Bay population dropped catastrophically after the settlers' arrival due to murder, European diseases and migration.

### ***The Chesapeake Piedmont***

The archaeological resources of the Piedmont areas of the Chesapeake Bay region are less densely-packed than the low lying Coastal Plain, due to the less intensive utilization of these lands over the long haul of prehistory. However, because of the increased slopes in these areas, more damage is expected to the extant archaeological record.

Many of the prehistoric archaeological resources of the Piedmont region pertain to the earliest phases of human occupation, when the subsistence base for these people included wide ranging areas for resource collection and extraction activities. Quarries, hunting camps, and trade routes to other areas outside the region all potentially lie within the Bay's uplands. Many of these sites are widely dispersed, reflecting a generally low prehistoric settlement density. However, with the coming of European settlements, many of these areas are likely to contain a variety of mining, milling, or military sites, in addition to myriad homesteads that have been lost to time.

In sum, many of the Piedmont archaeological resources are crucial to our understanding of the numerous transport and trade activities of the Bay's people, historic and prehistoric, as they knitted the Chesapeake watershed into an ever-growing and truly continental economy with increasing ties to the Midwest and beyond.

## **Historic Structures/Sites**

Three main periods can be recognized for the historic structures and sites located in the Chesapeake Bay region: Colonial, Industrial, and Modern. Each of these periods has ample examples scattered across the several states that make up the watershed. The National Register of Historic Places contains detailed records on literally hundreds of properties within the area of consideration, and scores more remain either eligible or potentially eligible for listing on the register. In addition, the Chesapeake Bay area contains a significant number of National Historic Landmarks.

Colonial period structures and sites display the character of the early development of the United States. Numerous examples may be found in the area, ranging from large Historic Districts, such as in Annapolis (ca. 1760s), to private homes, such as Montpelier (ca. 1745) in Prince George's County. Still scattered around the Eastern and Western Shores are several other prime examples of Georgian mansions, formal gardens and grounds, and architectural gems from the late Colonial/early Republic era.

Industrial period structures in the Bay region illustrate many of the important locations in the nation's industrial history, including the B&O Railroad (ca. 1827), the C&O canal (ca. 1815), and the smelting stacks at Principio, Maryland (ca. 1820). Still other locations mark the rise in economic importance of the region, and its major industries located in urban centers, such as Baltimore and Richmond. Similarly, a wide variety of historic houses pertaining to this period are located around the Bay, from palatial estates to humble workers' homes. In many ways, the historic structures and sites of this period are some of the Chesapeake Bay's richest resources.

Modern period architecture has its place in the Chesapeake Bay's cultural heritage as well. Many architects and planners developed new and different approaches in the Bay region. From one of the first planned communities, Greenbelt, Maryland, to one of the first enclosed shopping malls such as Wheaton Plaza, many 'modern' individuals set about modifying the Chesapeake landscape.

In sum, the Chesapeake Bay region is endowed with a wide array of historic structures and sites, and the efforts to identify and protect these invaluable resources continue today.

## Ethnographic Resources

Three main categories of ethnographic resources can be recognized in the Chesapeake Bay region: point-specific, regional, and seasonal. Each of these types of resources relates to different people (e.g., Native Americans, ethnic enclaves, traditional watermen), and at different times (e.g., mythical, prehistoric, historic), but they remain important aspects of our shared cultural heritage.

Point-specific ethnographic resources are usually single locations of specific importance to an identifiable group of people or routes used by escaping slaves along the Underground Railroad. Included in this category would be sacred sites, such as traditional burial grounds, Indian spiritual locations, or 'lookout points.' Many of these types of ethnographic resources are identifiable from extant features (i.e., graves), but some may require extensive consultation and local research to locate and record these properties.

Regional ethnographic resources often include wide-spread areas for resource acquisition and/or transport, and include rock quarries, Indian trails and traditional hunting or fishing territories. In many cases, these resources may be claimed by different and competing groups of people, but nevertheless, these remain important cultural resources to the Bay's history.

Seasonal ethnographic resources primarily include areas traditionally used for collecting seasonally-available resources, such as anadromous fish runs, deer hunting grounds, or ripening fruits and flowering plants. While arguably the most difficult to identify and protect, to many Native Americans, these resources define their traditional existence.

## SOCIOECONOMIC ENVIRONMENT

### Land Use (including Jurisdictional Boundaries)



**Figure 5-4: The Chesapeake Bay watershed includes the states of Virginia, Maryland, Pennsylvania, West Virginia, New York, Delaware, and the District of Columbia.**

Land uses throughout the Chesapeake Bay area vary from highly agrarian to highly developed, particularly in the metropolitan areas of Washington DC, Baltimore, and Hampton Roads. According to the Multi-Resolution Land Characteristic Consortium, only 9.3% of the land area in the Chesapeake Bay watershed is intensely developed, with 15.2% and 75.5% with commercial development or low intensity development respectively. Land cover across the large watershed area has the following breakdown: 3.6% developed, 28.5% agriculture, 60.1% forested; 4.3% water, 2.6% wetland, and 0.9% barren.

The Chesapeake Bay watershed includes the states of Virginia, Maryland, Pennsylvania, West Virginia, New York, and Delaware, and the District of Columbia, as shown in Figure 5-4. In 1983 and 1987, the states of Virginia, Chesapeake Bay Commission, and the U.S. Environmental Protection Agency (representing the Federal Government) signed historic agreements that established the Chesapeake Bay Program partnership to protect and restore the Chesapeake Bay's ecosystem. The Chesapeake Bay Program is a unique regional partnership that directs and conducts the restoration of the

Chesapeake Bay. Since its inception in 1983, this organization's highest priority has been the restoration of the Bay's living resources (e.g., finfish, shellfish, Bay grasses, and other aquatic life and wildlife). Improvements include fisheries and habitat restoration, recovery of Bay grasses, nutrient and toxic reduction, and significant advances in estuarine science.

Considered a national and international model for estuarine research and restoration programs, the Chesapeake Bay Program is a partnership led by the Chesapeake Executive Council. The members of the Executive Council are the governors of Maryland, Virginia, and Pennsylvania; the mayor of the District of Columbia; the administrator of the U.S. Environmental Protection Agency; and the chair of the Chesapeake Bay Commission. The Executive Council meets annually to establish the policy direction for the Program.

The Chesapeake Bay Agreement of 1987, created by the Executive Council, set a goal to reduce the nitrogen and phosphorous entering the Bay by 40 percent by 2000. In 1992, the Bay Program partners agreed to continue the 40 percent reduction goal beyond 2000, as well as to target nutrients at their source, upstream in the Bay's tributaries. As a result, Pennsylvania, Maryland, Virginia, and the District of Columbia began developing tributary strategies to achieve nutrient reduction targets.

On June 28, 2000, the Chesapeake Bay Program partners signed the new *Chesapeake 2000* Agreement, which guides the next decade of restoration and protection efforts throughout the Bay watershed. The agreement commits to protecting and restoring living resources, vital habitats, and water quality of the Bay and its watershed.

### **Population**

In 1970, the Bay watershed's population was 11,342,157; by 2000, that figure had grown to 15,710,840, an increase of 38 percent (USEPA, 2002). By 2020, it is expected that nearly 18 million people will live in the region. Table 5-2 shows the population within the watershed from each state, as well as projected population up to the year 2020. In order to accommodate these new residents, more homes will be built. If the current development pattern holds, many of these new houses will be located farther away from existing infrastructure, such as schools, businesses, and wastewater treatment facilities. From the 1970s through 2000, the number of households in the basin increased 17.5 percent (from 4.5 to 5.3 million). Household numbers have increased at a faster rate than the population due to a reduction in household size between 1980 and 1990 (Chesapeake Bay Program Office, 2002c).

<b>Table 5-2: Population Estimates and Projections for Portions of States in the Chesapeake Bay Drainage Basin</b>							
State	Population						
	1990	1995	2000	2005	2010	2015	2020
DC	606,900	554,255	536,750	547,375	576,924	607,211	636,380
DE	68,283	76,179	82,845	88,027	92,321	95,962	99,178
MD	4,731,408	4,987,703	5,256,268	5,485,176	5,675,036	5,867,451	6,052,542
NY	659,981	655,187	665,129	669,472	672,319	675,166	678,014
PA	3,277,323	3,386,069	3,433,056	3,485,046	3,537,020	3,568,973	3,600,916
VA	4,749,928	5,128,609	5,415,573	5,672,734	5,929,948	6,193,662	6,457,412
WV	180,828	196,661	204,620	215,318	225,255	234,343	242,188
TOTAL	14,274,651	14,984,663	15,594,241	16,163,148	16,708,823	17,242,768	17,766,630

Source: Chesapeake Bay Program Office, 2002c

In Maryland, the average lot size per household has increased (Chesapeake Bay Program Office, 2002c). An increase in household numbers coupled with an increase in lot size results in land being consumed for development at a faster rate than the population increase. In Maryland, population increased 35 percent between 1970 and 2000. Between 1973 and 2000, land consumed for residential development increased 66 percent.

A national study, *Weighing Sprawl Factors in Large U.S. Cities* by NumbersUSA provides a consistent means of quantifying the role of population growth in sprawl. According to U.S. Census data, increased per capita land consumption was associated with about 55 percent of the sprawl in a given watershed, and population growth was associated with about 45 percent of the sprawl. There is, however, a great variation among the different “Urbanized Areas” of the Chesapeake Bay watershed (Sprawl City, 2003). An “Urbanized Area” is defined by the U.S. Census Bureau as a contiguous developed land of the central city and its suburbs. Table 5-3, derived from this study, shows nine urbanized areas in the Bay watershed and the sprawl in terms of land area as it relates to population growth and growth in per capita land consumption.

<b>Table 5- 3 Urban Sprawl in the Chesapeake Bay Watershed</b>			
<b>Urbanized Areas</b>	<b>Sprawl in Square Miles from 1970-1990</b>	<b>Percent of Total Sprawl related to Population Growth</b>	<b>Percent of Total Sprawl related to Growth in per Capita Land Consumption</b>
Baltimore, MD	282.9	28%	72%
Hagerstown MD-PA-WV	4.8	47%	53%
Harrisburg, PA	71.4	30%	70%
Lynchburg, VA	65.7	32%	68%
Norfolk- Virginia Beach, VA <sup>1</sup>	221.4	85%	15%
Petersburg, VA	24.4	6%	94%
Richmond, VA	158.1	47%	53%
Scranton- Wilkes-Barre, PA <sup>2</sup>	20.4	0%	100%
Washington, DC-MD, VA <sup>3</sup>	450.1	47%	53%
<b>Totals</b>	<b>1299.2</b>	<b>45%</b>	<b>55%</b>
Source: <a href="http://www.sprawlcity.org/studyVA/chesapeake.pdf">http://www.sprawlcity.org/studyVA/chesapeake.pdf</a>			
<sup>1</sup> Includes Hampton, Newport News, Norfolk, Portsmouth, Suffolk, and Virginia Beach.			
<sup>2</sup> Prior to 1980, Scranton and Wilkes-Barre were separate Urbanized Areas.			
<sup>3</sup> Includes District of Columbia, Maryland and Virginia Suburbs and Arlington CDP (Census Designated Place).			
<sup>4</sup> Data range covers 1980 to 1990			

The Chesapeake Bay Watershed is divided into eight smaller watersheds. These include the Susquehanna, Patuxent River, the Eastern Shore, the Rappahannock, Maryland Western Shore, James, York, and Potomac River. The upper section of the Bay includes the Susquehanna and Maryland Western Shore Watersheds. The areas in these watersheds located along the Chesapeake Bay are industrial and commercial, such as the city of Annapolis, Baltimore, and Havre de Grace, Maryland. However, the southern portion of the Maryland Western Shore Watershed consists of forestland. Directly along the Bay, these areas have well-developed infrastructure of roads and are heavily populated (Chesapeake Bay Program Office, 2002e). This area showed an increase in population from 1990 to 2000, and projections anticipate a continual increase in population through the year 2020 (Chesapeake Bay Program Office, 2002e).

The middle section of the Bay consists of the Eastern Shore, Patuxent River, and Potomac River Watersheds. The areas located along the Chesapeake Bay within these watersheds consist mainly of forest and agricultural land. Still, areas highly developed with residential and commercial uses exist sporadically along the Chesapeake Bay (Chesapeake Bay Program Office, 2002e). These areas have a well developed infrastructure of roads. Populations, along the Bay, within these watersheds are denser than in other areas. An increase in population from 1990 to 2000 has occurred and projections anticipate a continual increase in population through the year 2020 (Chesapeake Bay Program Office, 2002e). This is especially seen in Prince George's, Anne Arundel, and Montgomery Counties, Maryland.

The lower section of the Chesapeake Bay includes the York, Rappahannock, and the James Watersheds. The area in these watersheds is mostly

agricultural and forested, with a little residential and commercial development interspersed. Populations in these areas are lower than in other areas of the Bay (Chesapeake Bay Program Office, 2002e). There was an increase in population from 1990 to 2000, and it is anticipated that there will be a continual increase in population through the year 2020 (Chesapeake Bay Program Office, 2002e). The area along the Bay is not anticipated to have a well-developed infrastructure of roads. The exception is seen in and around Norfolk, where there is a large concentration of development, population, and infrastructure (Chesapeake Bay Program Office, 2002e).

### ***Economy***

The economic mainstays of the Chesapeake Bay region since the late 1800s have been ports with their import and export, the seafood industry, agriculture, tourism, the military, and shipbuilding and repair (Chesapeake Bay Program Office, 2002d). Major ports in the Chesapeake Bay include the City of Baltimore and the City of Norfolk, transporting container cargo and products such as coal, grain, tobacco, cocoa beans, and rubber.

The seafood industry remains a major factor in the economic life of the Chesapeake Bay. The long-term outlook for the seafood industry is in question however, as over-fishing and pollution of the Bay and rivers have caused a decrease in marine life populations and a destruction of habitat. The Chesapeake Bay is the largest producer of crabs in the United States. More than one third of the blue crab harvest in the United States comes from the Bay (Chesapeake Bay Program Office, 2001b).

Agriculture plays an important part in the Chesapeake Bay Watershed. For example, in Virginia, statistics show that, over the past 40 years, farm production has increased 63 percent, while agricultural land use decreased 47 percent and labor decreased by 89 percent. Production of broiler chickens is the state's leading agricultural commodity, followed by milk, cattle, turkeys, tobacco, greenhouse and nursery plants, soybeans, eggs, winter wheat, and corn. Cotton is making a comeback with the new demand for natural fibers, and, in 1996, a new record was set for cotton production at 160,000 bales.

Tourism continues to play a key role in the economy of the Chesapeake Bay region. For instance, Maryland tourism reports show that visitors to the state in 2001 spent almost 7.7 billion dollars on goods and services, generated 646 million dollars in tax revenue, and indirectly provided more than 103,000 jobs. In Virginia, 275 historic attractions host more than 6.5 million visitors annually, with another 25 million annual visits to National Park Service areas.

The Chesapeake Bay economy is greatly influenced by a large military presence. A number of military bases border the bay or its tributaries. For example, at the mouth of the Bay, the Norfolk Naval Base contributes significantly to the economy in the tidewater area. Other bases on the Chesapeake Bay contribute to the local economies. They include but are not limited to Aberdeen Proving Grounds on the northern end of the Bay and Langley Airforce Base near the southern end. Nearly a third of the region's workers earn a paycheck from the Department of Defense or a defense contractor. Norfolk has the world's largest Navy base, and Portsmouth is

home to the world's biggest ship-repair yard (Chesapeake Bay Program Office, 2002d).

### **Transportation**

Only two bridges truly cross the Chesapeake Bay: the Chesapeake Bay Bridge-Tunnel and the William Preston Lane Jr. Memorial Bridge (commonly referred to as the Chesapeake Bay Bridge). The Chesapeake Bay Bridge-Tunnel crosses the mouth of the Chesapeake Bay and connects the City of Virginia Beach to Cape Charles in North Hampton County on the Virginia Eastern Shore. It is 17.6 miles long from shore to shore, crossing what is essentially an ocean strait. Including land approach highways, the overall facility is 23 miles long, and it carries highway traffic on US-13, the major arterial highway serving the corridor between Norfolk, Virginia, and Wilmington, Delaware (Kozel, 2002)

The Chesapeake Bay Bridge, officially the William Preston Lane, Jr., Memorial Bridge, crosses the Chesapeake Bay near Annapolis as part of US-50/US-301. The bridge's dual spans connect Maryland's Eastern Shore recreational and ocean regions to the metropolitan areas of Baltimore, Annapolis, and Washington, D.C. The bridge also forms part of an alternative route from the Delaware Memorial Bridge to the nation's capital (Kozel, 2002). The 4.3-mile Bay Bridge is a prominent and important element of the State of Maryland's transportation infrastructure. Carrying more than 23 million vehicles a year, the bridge consists of two separate spans with roadways running 186 feet above the water. The original span was built in 1952 and provides a two-lane roadway for eastbound traffic. The parallel structure opened in 1973 and has three lanes for westbound travelers.

The Bay's ports and waterways are critical to the world's commerce. Approximately 90 million tons of imports and exports pass through the major ports of Baltimore and Hampton Roads each year (The Mariner's Museum, 2002).

### **Parks and Recreation**

There are many parks and recreation areas in the Chesapeake Bay watershed area. The Chesapeake Bay Gateways Network, a partnership system of sites, land trails, and water trails, around the Chesapeake Bay watershed, represents a broad cross-section of Bay area parks. The Gateways Network includes more than 140 parks, refuges, historic ports, museums, and trails. More specifically, it includes 21 state parks, 8 units of the National Park System, 5 national wildlife refuges, 18 museums, an Indian reservation, 17 water trails, and a number of other sites (Chesapeake Bay Gateways Network, 2002). In addition to the Chesapeake Bay Gateways Network, there are other local parks and over 500 public access sites which are catalogued through the *Public Access Guide-Chesapeake Bay, Susquehanna River, & Tidal tributaries* (<http://www.chesapeakebay.net/visit.htm>).

### Visitor Use

The study area is a destination for local, regional, and out-of-state visitors. While tourism and visitor use statistics are often misleading due to double-counting and the undifferentiated economic impacts of local visitors versus those from out-of town, it is important to understand the magnitude of visitation throughout the area and at specific sites. Statewide tourism statistics are not available due to the difficulty in gathering such data. With a variety of destinations serving many different populations, the District of Columbia, Maryland and Virginia all have a wide variety of visitor attractions.

From a regional perspective, Table 5-4 shows 2002 visitation statistics for National Park Service sites in each state in the Chesapeake Bay watershed as well as the increase or decrease in visitation from 2001. The District of Columbia, Virginia, and Pennsylvania rank in the top five states for national park unit visitation.

The Chesapeake Bay region has many historic and cultural resources that attract local, regional and national visitors. Table 5-5 outlines several major attractions by urban area and their annual visitation statistics. It is evident that the region is a hub for a variety of tourist activities.

<b>Table 5-4 Visits to National Park Units by State and Percent Change from 2001 to 2002</b>			
	Visits 2002	Visits 2001	Percent Change
District of Columbia	24.4 Million	28.8 Million	-15.4 %
Virginia	25.0 Million	24.6 Million	1.6%
New York	15.7 Million	16.6 Million	-5.4 %
Pennsylvania	8.3 Million	8.1 Million	2.8%
Maryland	3.3 Million	3.4 Million	-3.6%
West Virginia	1.9 Million	2.1 Million	-7.7%
Delaware <sup>3</sup>	0	0	0

<b>Table 5-5 Visits to Major Attractions by Chesapeake Bay Urban Area</b>		
Metro Area	Attraction	Visits per year
District of Columbia	Lincoln Memorial The White House	3.55 Million 178,000
Baltimore, Maryland	The National Aquarium	1.6 Million
Hampton Roads, Virginia	Virginia Air & Space Center	250,000
Annapolis, Maryland	Maryland State House/Capitol Visitor Center United States Naval Academy	170,000 1.5 Million

The visitation rates at several different types and sizes of resources within the Chesapeake Bay Gateways Network serve as a proxy for the tourist activity at state parks, museums, and historic sites. The annual visitation rates, as illustrated in Table 5-6, vary widely.

<sup>3</sup> Delaware does not have any National Park System units.

<b>Table 5-6 Visits to Other Chesapeake Bay Gateways Sites</b>		
<b>Gateways Site</b>	<b>Location</b>	<b>Visits per year</b>
Gunpowder Falls State Park	Kingsville, Maryland	543,000
First Landing State Park	Norfolk, Virginia	1 Million
Blackwater NWR	Cambridge, Maryland	120,000
Chesapeake Bay Maritime Museum	St. Michaels, Maryland	95,000
Fort McHenry NMHS	Baltimore, Maryland	673,000
Colonial NHP	Yorktown/Jamestown, Virginia	3.3 Million