Introduction

The unique history, culture, and economic success of the Charleston region are inseparable from its ideal location at the confluence of two major rivers and the Atlantic ocean. The land area that drains into Charleston Harbor (its “watershed”) is made up of two river basins, the Ashley and the Cooper. The Ashley River Basin covers 894 square miles and the Cooper River Basin 843 square miles. The Ashley/Cooper River Basin (commonly known as the Charleston Harbor Watershed) extends inland 45 miles and includes three large freshwater lakes: Lake Moultrie, Bushy Park Reservoir, and Goose Creek Reservoir. According to the 2010 census, the tri-county Charleston metropolitan area covers portions of Berkeley, Charleston and Dorchester counties and has a population of 664,607 people, the largest communities being Charleston, North Charleston, Summerville, Mount Pleasant and Goose Creek.
The Ashley River rises from the Wassamassaw and Great Cypress Swamps in western Berkley County, making it a “blackwater” river in origin. Several streams drain into the Ashley, including Dorchester Creek. The Stono River meets the Ashley by way of Elliot Cut. A 24-mile stretch of the Ashley River (extending from Slands Bridge near Summerville to the Mark Clark Expressway Bridge in Charleston) was designated a State Scenic River in 1998. Where the Ashley joins the Cooper River south of the Battery, they flow together into the Charleston Harbor estuary, the area where the rivers and the salt water of the Atlantic ocean mix.

The Cooper River is mainly a tidal river. Along its course, it merges with Mepkin Creek to form the West Branch of the Cooper River, which converges with the East Branch Cooper River (this area is known as the “T”). The river is then is joined by the Back River, Goose Creek and the Wando River before finally joining the Ashley at the Harbor to flow into the estuary. The basin includes a cluster of barrier islands facing the Atlantic (e.g., Folly, Sullivan’s, Kiawah and Isle of Palms).

**Human Impacts: Physical Changes**

Before the English settlers arrived in 1670, the Charleston Harbor Watershed included 1400 square miles of virgin forest, rich salt and freshwater marshland, and pristine rivers and streams. Deer, bear, elk, wild turkey, and smaller game roamed the forests. Fish, oysters, and clams were abundant in the tidally influenced portions of the Cooper and Ashley Rivers.

With time and increasing human intervention, the watershed itself began to change. The major cultivation of rice transformed many wetland areas. In the mid-18th century, growers learned to take advantage of the tidal rivers and created systems of ditches, dykes and sluice gates. These were used to drain the mudflats for rice sowing and to back fresh water over the flats for cultivation. In the early 19th to the 20th century, the area we call downtown Charleston (once known as “Oyster Point” because of the numerous oysters that ringed its shores) doubled in land area as wetlands were filled in. The flooding in the city that follows heavy rains and high tides is a reminder that much of the city is filled lowland.
In 1939, a huge engineering project began that further transformed the hydrology of the watershed. The Santee-Cooper Hydroelectric Project damned the headwaters of the Cooper River, forming Lake Moultrie, which was connected to Lake Marion on the Santee River by a canal. By including the drainage area of the huge Santee River basin in the Ashley/Cooper River Basin, the watershed suddenly increased in size to 15,600 square miles.

The Cooper River, once a slow moving tidal slough with an average flow rate of 417 cubic feet per second became a major river with an average flow rate of 5,339 cubic feet per second. The greatly increased freshwater flow caused salinity in Charleston Harbor to decline 20%. The increased flow also dropped so much silt and sand in the harbor that 7,600,000 cubic yards of sediment had to be removed annually to keep the navigation channels open. To solve this major problem, an 11 mile rediversion canal from Lake Moultrie to the Santee River was completed in 1985. The canal sent 70% of the Santee drainage back into the Santee River, considerably reducing the flow into the Cooper River and increasing the harbor water’s salinity. The long-term impact of these changes on the habitat and resident plants and animals in our watershed is not yet known.

Smoking Shrimp: Phosphate Mining and Fertilizer Production

The history of the Charleston Harbor Watershed includes the story of the pollutants that entered the watershed as population and industry grew. Starting in the 1870s, as the rice plantations declined and disappeared, Charleston developed a booming phosphate mining and fertilizer production industry. Rich deposits of phosphate-laden marl, a mixture of clay and chalk, were discovered in Charleston’s river beds and underground. The legacy of millennia of buried bones and teeth from prehistoric animals, the deposits were called the “Fish Bed of the Charleston Basin.” These rich beds ran parallel to the coast of South Carolina for 70 miles, with local outcrops on the banks of the Ashley, Cooper and Stono Rivers and their tributaries, extending miles inland as well.
Economically pressed planters sold or rented land to the growing number of mining companies, with riverbank sites becoming more popular than inland sites because of the relative ease of excavation. Much of the work involved dangerous, hard labor along creek and river beds and was accomplished primarily by former slaves. The crude mined phosphate was chemically altered by fertilizer companies into soluble phosphoric acid. By the late 19th century there were over two dozen companies mining and/or producing fertilizer in the watershed. As of 1885, Charleston was producing one-half of the world’s phosphates. The mining industry began to decline after the earthquake of 1886 damaged many of the buildings along the Ashley River. New phosphate sources were located outside South Carolina and the mining industry was gone by 1938.
The phosphate industry had a dramatic environmental impact on both sides of the Ashley River, replacing antebellum plantations with mills, wharves, drying sheds and smokestacks. While these landmarks gradually disappeared, the legacy of pollutants remains today. High levels of phosphorus in the mud of the Ashley River from past industrial discharges have caused the mud to smoke during extreme low tides. Phosphorus (which ignites when exposed to air) was also responsible for a remarkable incident in 1992 when locally caught shrimp flickered orange when set to cool on ice.

Nine fertilizer plants in Charleston Neck continued to operate from around 1900 to the 1970s. The sulfuric acid that they used to turn phosphate ore into soluble phosphoric acid was stored in lead-lined containers. Today, old ditches can carry acidic water into the Ashley River, transporting a cocktail of lead and arsenic. Some of the former phosphate fertilizer sites along the Ashley River have been recognized by the US EPA as nationally significant hazardous waste sites or “Superfund” sites, where uncontrolled pollutants threaten the ecosystem or human health. At each of these sites, acidic pH conditions and lead and arsenic pollution have impacted the soil, sediment, and groundwater. Planned clean-up activities have been completed at the 15 acre Stono Phosphate Works and the 30 acre Atlantic Phosphate Works sites. Groundwater monitoring continues at these sites. However, clean-up is underway at the Swift Agri-Chem (43.6 acres) and has not yet begun the Columbia Nitrogen (43 acres) sites.
Legacy Pollutants

Other past industrial land uses have also left their signature on our watershed. Once the industrial backbone of Charleston, the Neck area holds a legacy of chemicals that continue to pollute the land and groundwater of the area, as well as the Cooper and Ashley Rivers.

Nitrogen levels in the lower Ashley (like the phosphate levels) are among the highest in the state due to past industrial discharges. Other industrial pollutants include creosote from the Koppers wood treatment plant that operated in the Neck from 1940 to 1977, contaminating 45 acres of land as well as groundwater and runoff entering the Ashley River. This site was declared an EPA Superfund site in 1998 and required a massive cleanup to reduce the levels of contaminants to a level considered safe for humans. Groundwater monitoring continues at the site. Also in the Neck area, the 147 acre Macalloy Corp. Superfund site formerly housed a ferrochromium plant on Shipyard Creek. Soil, sediment and groundwater were contaminated with hexavalent chromium. In addition, there was radiological debris contaminating the soil and nickel and zinc in the sediments. Cleanup efforts have been completed and monitoring is ongoing at the site. In Shipyard Creek itself, the concentration of chromium in the sediments continues to be among the highest in the world.

Along the Cooper River, the site of a coal processing plant known as “the old gas works” (operational from 1855-1957) was identified by EPA as the Calhoun Park Superfund site. Coal tar, a byproduct of gas production, was found in sediment, surface waters and in seeps along the river and in groundwater under the site, posing a health threat and delaying construction of the South Carolina Aquarium for years. Post-cleanup monitoring of the site continues to this day.
In addition to former industrial sites, old landfills and dumps can contribute pollutants to our waterways. As pollutants run off from land surfaces and leach from sediments, they can accumulate in creek beds where they enter the food chain and accumulate in aquatic organisms. For example, research led by Dr. Fred Holland for South Carolina Department of Natural Resources in collaboration with the NOAA Center for Coastal Environmental Health and Biomolecular Research has confirmed that the sediments of New Market Creek off Morrison Drive are heavily polluted. After the 1930s, the headwaters of the creek were filled in. Leachate from old landfills (the now inactive Romney Street landfill borders the creek), dumps, and stormwater runoff polluted the creek with copper, chromium, lead, polycyclic aromatic hydrocarbons (PAHs, from vehicle exhaust and pavement), and polychlorinated biphenyls (PCBs, which were outlawed in 1977 but persist in the environment).

Today our waterways are still impacted by the legacy of past land uses and the pollutants they generated. The impacts of these pollutants on tidal creeks like New Market Creek continue to be studied as a way to assess the health of our coastal ecosystem.

**Holy Sewage: Privys to Plum Island**

From about 1680 on, Charlestonians used privys to collect and dispose of human fecal waste. These small wood or brick buildings were built over a wood or brick vault. The vaults were periodically emptied into barrels, a gruesome task, by men called “vidanguers” and the contents transported to the outskirts of the city to be dumped on a farm. By the late 1800s, Charleston had approximately 10,000 privy vaults, of which only 10% were emptied in a given year. Drinking water cisterns were often located close to privys, posing a serious health risk. Diseases like cholera were common problems.

The patchwork of existing drainage built between 1806 and 1840 was inadequate to deal with the cocktail of animal, kitchen, laundry and industrially polluted wastewater it carried. During a yellow fever
outbreak between 1854 and 1858, the City of Charleston created the Committee for Health and Drainage to plan for a storm drainage and sanitary sewer system for the city.

An early effort to deal with the issue involved the construction of a series of underground brick storm drains. They were 3.5 feet wide and 4.5 feet high, running the length of Calhoun Street from the Cooper to the Ashley River, the length of Meeting Street between Spring Street and the White Point Gardens wall, from Calhoun Street down Coming Street and through Limehouse Street to the Ashley River, and from Calhoun Street a short distance north on Chestnut Street to the marsh (now Hagood Avenue). At each outlet there was an outfall with a gate that was opened at high tide to allow water to fill the drains. Once full, the drains were closed until low tide when they were opened and the water flushed out. Despite the name, the “tidal” drainage system was never effectively flushed and scoured by the tides. According to local lore, one unusual use of the old system was the transport of bootleg whisky during Prohibition. A rowboat filled with whisky bottles supposedly traveled from the old Chestnut Street outlet to a manhole in the city where an enterprising bootlegger distributed the bottles.

Despite this effort, disease outbreaks continued. By the late 1800s, scientific pioneers like Louis Pasteur had made it clear that microbial pollution in contaminated water could cause disease. City officials were aware that a separate sanitary sewer system and stormwater system were needed for Charleston’s wastewater. However, lack of an adequate fresh water supply to run the system made it a challenge. In 1895, R.F. Hartford proposed a feasible design and the city laid sewer lines in most of the area south of Broad Street and built two steam driven pump stations. A wooden flume discharged the raw sewage directly into the Ashley River. The rest of the city remained without access to sewers, with 65,000 people still relying on privy vaults. The construction of a freshwater reservoir by Charleston Light and Water Company between 1902 and 1904 (by damming Goose Creek) provided an adequate water supply.
for expansion of the sewer system. With an adequate water supply secured, the city created 7 districts, each equipped with its own pumping station. New outfalls were created on the Ashley at Spring and Beaufain Streets and on the Cooper River at Calhoun and Market Streets.

As a result of the sewer expansion project, by 1912, much of Charleston had sewer line access. Despite a city ordinance that required connection once water and sewer access were available, many tradition-bound property owners were reluctant to connect instead preferring their “grandfather’s cistern” water. Eventually, by 1917, the number of privy vaults was reduced to 800-900. However, new construction in unsewered areas continued during this period and privy vaults were likely still being added. As development outpaced sewer and water supply many homes were connected to stormwater drains. Finally, in the 1940s, the city mandated connection to city water and sewer as a requirement for obtaining a building permit. With the Wagener Terrace sewer expansion, the entire peninsula was provided with sewer lines.

As Charleston grew, it began to feel the impact of pumping untreated sewage into the Ashley and Cooper Rivers. Water quality had deteriorated and many local waterways and beaches were impacted by bacterial pollution and became unfit for swimming and shellfishing. By the early 1960s, several fish kills focused public attention on the lengthy history of sewage and industrial pollution in Charleston harbor. In 1963 the South Carolina General Assembly passed a law mandating that local municipalities have wastewater treatment in place by 1970. The federal Clean Water Act of 1972 followed, setting the framework for enforcement of laws to prevent pollution of waterways across the United States.

Local cities and towns attempted to coordinate the construction of a single collection and treatment system but were unable to reach an agreement so each municipality began to develop its own treatment plant. The City of Charleston’s Plum Island Treatment Plant was completed near James Island in 1971. A series of deep tunnels carried sewage from the city under the
Ashley River to the new treatment plant. After treatment the wastewater was discharged to the Ashley River, as it is today, in about 30 feet of water approximately 1000 feet from White Point Gardens.

Even with completion of the city’s collection and treatment system there were still old and even some new homes and business inadvertently connected directly to the stormwater drainage system sending raw sewage directly into the harbor. Eliminating these illegal connections is an ongoing effort by the City of Charleston and Charleston Water System. Over time as the Charleston area’s population grew, the capacity of the Plum Island Treatment Plant increased from an initial capacity of 18 million gallons per day to its current 36 million gallons per day.

An Economic Resource

The Port of Charleston

The Port of Charleston has acted as the heart of the watershed’s economic activity for three centuries. In 1663, Charles II of England granted Carolina to eight of his loyal friends, called the Lords Proprietors. One of them, Anthony Ashley-Cooper, determined that the territory should include “a great port town.” Moved in 1680 from Albemarle Point on the west bank of the Ashley River to its present location on the Peninsula (Oyster Point), Charles Towne had the deep water of the Cooper River opening into the Atlantic, making it an ideal port. A fortification wall helped to protect the city from attacks from Spain and France, as well as from pirates and the local Cusabo tribe.

By the mid-1700s, the city was a busy trade center, the fourth largest port in the American colonies. Lowcountry rice and indigo crops helped to fuel a bustling shipping
industry. In 1774, a year after the famous Boston Tea Party, Charleston had its own protest of British tea taxes as residents of the Port of Charleston confiscated tea and stored it in the Exchange and Custom House. Later that year, on the steps of the same building, citizens declared independence from Britain. British presence, however, remained strong until 1782 when the British retreated and the city was renamed Charleston.

Following the Revolution, Charleston continued to grow and prosper, becoming the wealthiest city in the South and its cultural and commercial center. The invention of the cotton gin in 1793 caused cotton production to boom, and cotton became the port’s major export and economic engine. By 1820, Charleston had a population of 23,000 black and white inhabitants. Slave traders used the port to unload ships from Africa. Charleston’s status in the 19th century as one of the busiest ports in the country was challenged by the Civil War, when Union blockades shut down most commercial traffic. During the war, Charleston Harbor was the site of the first successful submarine attack in history when the H.L. Hunley attacked the U.S.S. Housatonic in 1864. Another blow to the port’s economy was a huge earthquake in 1886 that nearly destroyed Charleston, damaging 2000 buildings. The local economy languished in the 1900s but United States military presence helped to sustain the port.

The Military Port

Military projects and installations have long been an important part of the history and economy of the Port of Charleston. Early U.S. Army sponsored projects included building Fort Moultrie beginning in 1776, Fort Johnson in 1826, and Fort Sumter in 1829. The Army Corps of Engineers worked to control erosion on Sullivan’s Island beginning in 1829 and began maintaining a navigation channel in the Harbor in 1851. Later in the century, the Army Corps helped to clear the Harbor of ships sunk during the Civil War. In 1885, the Corps constructed a pair of jetties at the mouth of the Harbor to funnel the scouring power of the ebb tide and stabilize the Harbor’s navigation channel.

In the 1930s, the Army Corps linked canals created to aid coastal
navigation to form the Atlantic Intracoastal Waterway. World War II led to the major construction of airfields (now largely public) and harbor defenses. The U.S. Navy was also active in Charleston, establishing a base on the Cooper River. The Charleston Naval Shipyard, naval station, and distribution center were an important part of the local economy through the Cold War. These facilities were all closed by 1996.

The Charleston Naval Weapons Station remained active and has expanded its military missions, gaining a major role in the local economy. It serves as the largest single employer in the Charleston area with more than 11,000 employees and covers over 16 miles of waterfront. The Air Force has had a major presence as well since 1931, with Charleston Air Force Base providing international defense support. In 2010, the facility became Joint Base Charleston, combining the US Air Force Base and Charleston Naval Weapons Station, now called US Navy Support Activity Charleston. A 2004 study indicated that, overall, the military injects over $3 billion into the local economy.

The Modern Port

Owned by the South Carolina Ports Authority, the Port of Charleston is one of the largest ports in the U.S. and has the deepest water of any port in the southeast. It has five terminals, two on the harbor, two on the Cooper River in North Charleston and one on the Wando River in Mount Pleasant. After tourism, the Port provides the major source of Charleston’s economic activity. The shipping terminals are part of the fourth largest container seaport on the east coast. They are:

- Wando Welch in Mt. Pleasant: largest terminal, handles container cargo
- Columbus Street in Charleston: project cargo, breakbulk and rollon-roll off cargo
- Union Pier in Charleston: breakbulk and roll on-rolloff, cruise ship operations.
- North Charleston Terminal: container cargo
- Veteran’s Terminal in North Charleston: breakbulk and bulk cargo
A new container terminal under construction at the former Charleston Naval Complex will increase the port’s container capacity by 5 times.

The depth of Charleston Harbor’s navigation channels allows the port to accommodate ships too large to use the Panama Canal. A planned deepening project will increase the depth of the channel beyond the current depth of 45 feet (at mean low tide) throughout the shipping channel and 47 feet in the entrance channel. After completion of an expansion of the Panama Canal in 2014, large ship traffic should increase in the Port of Charleston.

In 2008, the Port handled 62.4 million tons of cargo, two-thirds of which were imports, one-third exports. Products handled included textiles, clothing, forest products, chemicals, machinery, vehicles, boats and aircraft, food, furniture and hardware. The location of the Port encourages the local siting of manufacturing facilities. For example, the BMW factory in Greer, SC exports cars from its only North American plant through the Port of Charleston.

Recreation and Tourism

The Ashley-Cooper basin is blessed with abundant natural resources, including rivers, lakes and marshes, beaches, sea islands and forests. Fish abound in the freshwater lakes and rivers. Mudflats and marshes spawn shrimp, mollusks, crabs and fish. Dolphins and porpoises ply the tidal creeks and the estuary and offshore waters are brimming with life. These resources fuel an enormous amount of economic activity, including recreation (e.g., swimming and sunbathing, kayaking and canoeing, motor boating, fishing, stand-up paddle boarding, surfing
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and kiteboarding), tourism and commercial fishing. In addition to the economic benefits, a majority of the people of South Carolina benefit directly in a personal way from the local fresh and saltwater resources. The results of a 2005 survey conducted by the South Carolina Department of Parks, Recreation, and Tourism indicated high levels of participation in popular water-related recreational activities among the state residents.

Beaches: According to the table above, nearly two-thirds of the state’s adults used South Carolina’s beaches on an annual basis in 2005! The beaches of the Charleston region are a world-class resource and destination for both residents and tourists. For example, Folly Beach offers six miles of sand and the areas largest waves for surfers. Kiawah Island has 10 miles of oceanfront as well as freshwater lagoons and marshes. Three-mile long Sullivan’s Island offers a sandy beach and winds that attract both wind-surfers and kite-boarders.

Recreational fishing: The popularity of freshwater fishing is evident in the table above, with over one-third of South Carolina adults participating in the sport in 2005. Popular target species for fishermen include crappie, bream, largemouth bass and catfish. A recent article in the Post & Courier noted that fishing and hunting are becoming popular ways to help balance the food budget in a tough economy. In South Carolina, there has been a 40 per cent increase overall in hunting and fishing licenses issues over the period from 2006 to 2011.

A total of 208,204 saltwater recreation licenses were sold in the state in 2010, nearly double the number sold in 2006, a testament to the increasing popularity of saltwater fishing. The primary species fished are finfish (e.g., red drum, spotted sea trout, southern flounder, spot),
white and brown shrimp, crab and shellfish (oysters and clams). “Scratching” for hard clams and dislodging clusters of oysters from mud banks with hammers at low tide are still popular local traditions.

Boating: In 2010, the state held eighth place nationally in recreational boat registrations, with 435,491 registered craft. It is estimated that there is one boat for every 12 people in the state!

Commercial Fishing: State-wide, the economic impact of commercial fishing was estimated in 2009 at $33,939,909. Shrimping is by far the dominant fishery, with commercial trawlers bringing in 6 million pounds annually, valued at $30 million. Shrimping has a colorful history in the Charleston area, starting with the “Mosquito Fleet” in the 1850s. These commercial shrimpers were primarily slaves who used whatever vessels were available, netting the shrimp by hand in seives and marketing them from carts on the streets of Charleston. Since the 1920’s, the docks of Shem Creek in Mount Pleasant have been home to a fleet of high-bowed, flat-bottomed shrimp trawlers topped with outriggers that swing out on each side to lower the huge nets. The trawlers work offshore, mostly within 3 or 4 miles of the beach. Each year, a colorful local festival centers on blessing each of the fishing vessels that go in and out of Charleston Harbor.

A small group of “watermen” in Charleston make their living as professional shellfish harvesters. Dave Belanger (“Clammer Dave”) is one of these, farming clams and oysters for a decade in 25 acres of intertidal bottom leased from the state along Capers Island Wildlife Refuge. His oysters are popular with local restaurant chefs and are culled by hand with a chisel, a process
that dates back 200 years. For over 20 years, Toby Van Buren has pulled clams and oysters from the pluff mud in an area he leases from the state near Breach inlet. He uses nets to protect his clam beds from predatory sting rays, crabs and flounder. The pioneers represent a new wave of shellfish growing and harvesting in our local waters.

*Underappreciated Assets: The Economic Impact of South Carolina’s Natural Resources*, a 2009 study by the University of South Carolina Moore School of Business, found water-based recreational activity and coastal tourism have a $10,840,145,849 economic impact in South Carolina. The study included both direct and indirect impacts like employment and income and concluded “well-managed” natural resources are “integral” to economic development. The Charleston Harbor Watershed water-related natural resources not only define the region’s history and culture but also fuel the local economy and provide a high quality of life for local residents.
Sources


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Fact Sheet:
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