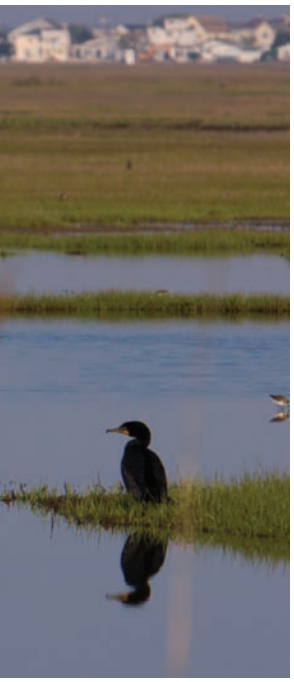
A Vision for the Future of Conservation

BARNEGAT BAY 2020



THE TRUST *for* PUBLIC LAND

CONSERVING LAND FOR PEOPLE

BARNEGAT BAY 2020

A Vision for the Future of Conservation

A Report by
The Trust for Public Land

July 2008

Contents

Preface

Perched on the highest spot at Ocean County College, I can see Barnegat Bay off to the east. The view from this vantage point provides a respite from work and reminds me of other favorite coastal perches—coastal cliffs in southern New England, the bluffs of the Palisades along the Hudson River, and the coastal highway that winds along the craggy coast near Big Sur. Perhaps most importantly, the view here reminds me that all of us in the Barnegat Bay watershed, like the inhabitants in those other coastal areas, are poised on the edge of other less welcoming cliffs—cliffs of our own making.

One such cliff comprises this country's coastal counties, as they become home to an increasingly greater percentage of the U. S. population every year. Located between two of the largest metropolitan areas in the United States, the Barnegat Bay watershed is home to roughly 600,000 people and hosts nearly half a million additional vacationers every summer. This population growth and tourism have brought many benefits, including educational and recreational opportunities and economic prosperity, and have led to Ocean County being recognized as one of the best places in the country to live.

Yet this growth has also brought a number of costs, many of which are not well recognized. In addition to the overall loss of open space (much of it along the waterfront, which provides vital ecosystem services such as storm surge protection), population growth has fragmented habitats for fish and wildlife, altered the runoff of precipitation from the land, and affected river flows and local erosion patterns. Many of these changes make people and property more vulnerable to coastal hazards. This growth has also lead to substantial decreases in water quality throughout the watershed. Coastal ecosystems are increasingly being recognized as sensitive to these disturbances and as suffering disproportionate impacts from such activities.

Another imposing cliff represents the natural lands that are vanishing from the Barnegat Bay watershed. Roughly 30 percent of the watershed has been developed. As development proceeds beyond this tipping point, ecosystems begin to change in many ways, often unpredictably. Sensitive species may be lost, and ecosystem functions, many that we take for granted, may be compromised. If we don't recognize the point upon which we stand, we may lose the very qualities that attracted us here. Thus, it is vital that we take immediate steps to protect the remaining open space throughout the watershed.

In recognition of these cliffs, The Trust for Public Land (TPL) pulled together the regional stakeholders—local, state, and federal agencies, educational institutions, and other non-governmental organizations—to identify the most important remaining open space and to renew our commitment to its protection. Land acquisition is vital to protecting the fish and wildlife we cherish, maintaining essential yet widely unrecognized ecosystem services, and sustaining our quality of life. The Barnegat Bay National Estuary Program and its many partners have identified the acquisition and protection of open space within the watershed as fundamental to efforts to protect and improve water quality throughout the bay watershed.

The current TPL effort, the *Barnegat Bay 2020*, builds upon TPL's 1995 *Century Plan*, which to date has led to the acquisition of almost 24,000 acres throughout the watershed. As Terry O'Leary, president of the Natural Resource Education Foundation of New Jersey, noted at one planning meeting of the many stakeholders that contributed to *Barnegat Bay 2020*, "the *Century Plan* guided land acquisition and protection in Ocean County for more than a decade. It's vital we continue this effort."

As I gaze out at Barnegat Bay from my cliff at Ocean County College, I ask you to join me in working with The Trust for Public Land and its many partners to make this effort successful by supporting the acquisition and protection of open space remaining in this vibrant watershed.

Stan Hales,
Director, Barnegat Bay National Estuary Program
July 2008

Introduction

For more than twenty years, The Trust for Public Land (TPL) has worked with local partners in New Jersey's Barnegat Bay region to preserve this nationally recognized refuge and recreational destination. TPL's *Century Plan* (1995) identified 75,930 acres in the Pinelands, along the coastal shoreline, and among bay islands that were considered, in the words of that report, "of long-term importance to the Barnegat Bay as an ecosystem and a treasured public resource." While almost 24,000 identified acres have been protected, at least 4,525[1] of the original *Century Plan* acres have been lost to development. Much remains to be done—more than 16,000 of the 1995 plan's identified acres have again been identified as priorities for acquisition in this most recent study. TPL is strengthening its commitment to the region with *Barnegat Bay 2020*. This report is divided into two sections: (1) a look at the current conditions in the bay watershed based on recent scientific studies and (2) an explanation of the land conservation goals drawn up by a steering committee convened by TPL.

The Barnegat Bay Current Conditions

A rapidly growing population and the associated development of agricultural and vacant lands have brought a host of environmental problems to the Barnegat Bay watershed. However, land conservation campaigns, combined with a sophisticated regulatory framework, are helping prevent further degradation by strategically protecting vital habitats and water supplies and in some instances restoring natural functioning systems.

The Watershed

The 425,117-acre Barnegat Bay watershed is located almost entirely within Ocean County in east-central New Jersey. Like the county, the watershed is shaped roughly like a wedge—widest in the north and narrowest in the south—and drains into the Barnegat Bay. The northern boundary extends just north of the Ocean County border into Freehold and Howell townships in southern Monmouth County with the western boundary well inside Ocean County except for a sliver of Bass River Township. The eastern boundary begins in Point Pleasant Beach Borough and borders the ocean south to the Beach Haven Inlet, less than fifteen miles from Atlantic City. The Barnegat Bay estuary, a 42-mile-long brackish lagoon, has been extensively studied for its recreational and ecological value. In 1995 the U.S. Environmental Protec-

[1] This figure is the number of acres within *Century Plan* sites that are now classified as urban based on 2002 land-use/land-cover data from the New Jersey Department of Environmental Protection. The remaining 71,000-plus acres still have natural land cover, which includes altered and barren land. However, this figure is somewhat outdated and underrepresents the amount of land lost to development because it is based on data from 2002.

tion Agency declared the Barnegat Bay watershed to be a threatened "estuary of national significance" and established the Barnegat Bay National Estuary Program.

Population Change and Land Development Patterns

Ocean County[2] is the most populated and fastest-growing county in New Jersey. It has experienced exponential growth since at least the 1950s, shortly after completion of the Garden State Parkway. From 1930 to 1960 the population rose from 33,000 to 108,000. The U.S. Census estimated population for 2007 was 565,000, a 400 percent increase from 1960.[3] During the summer, the population spikes to over one million with seasonal residents.[4]

Viewed from west to east, the Barnegat Bay watershed can be broken into three main regions that roughly correlate with the extent and type of development found in the county: (1) the Pinelands or headwaters region, (2) the coastal region on the west side of the estuary, and (3) the barrier island complex region on the east side of the estuary. While the coastal and barrier island complex regions support the most development, it decreases in intensity from north to south along the western coast of the estuary. Owing to tight monitoring by the state's Pinelands Commission (which oversees implementation of the Pinelands Comprehensive Management Plan), development in the Pinelands region is limited, although in recent years there has been significant development around the periphery of the region in the Toms River subwatershed. Most of the development in the Barnegat Bay watershed consists of residential homes built around the estuary.[5]

Relatively few county residents work in industries that can be directly tied to the natural resources of the watershed. More than three-fourths of county workers are in retail trade or service industries (Six Flags Theme Parks, Inc., and Saint Barnabus Health Care), or defense-related sectors (Lakehurst Naval Air Engineering Station).[6] In 2000 only about 1 percent of Ocean County residents employed in the private sector were listed as working in the fishing, hunting, or general agriculture industries. But this figure does not take into account the overall economic impact of the region's natural resources. A recent state report, which analyzed the total value of the state's natural goods (e.g., timber and fish) and services (e.g., food production and nutrient cycling by water bodies), found that estuarine and freshwater wetlands are the most valuable ecosystems, producing as much as $11,802/acre/year and $11,811/acre/year, respectively. [7] Furthermore, the state's wildlife-related tourism is estimated to create about $3 billion annually in economic activity, which shows why it is vital to the economy to maintain public access to healthy natural lands and water bodies.[8]

The 2008 Ocean County Tax Board Report on Land Parcels by Classification showed that about 85 percent of all available land parcels (not acres) are residential, the majority of which are detached one-unit structures. The same report

[2] The demographic data for this report are only for Ocean County. However, a small portion of southern Monmouth and eastern Burlington counties are technically within the boundaries of the Barnegat Bay watershed.

[3] U. S. Census Bureau, "Ocean County Quickfacts," 2008, quickfacts.census.gov/qfd/states/34/34029.html.

[4] Correspondence with Ocean County Planning Director David McKeon, June 16, 2008.

[5] Barnegat Bay National Estuary Program, *Comprehensive Conservation Management Plan* (Toms River, NJ: 2002), 18–19. The complete plan is available at www.bbnep.org/studies.html.

[6] NJ Department of Labor, "Annual Private Sector Report for Employment and Wages in Ocean County," 1990 through 2000, www.planning.co.ocean.nj.us.databooktoc.htm

[7] NJ Department of Environmental Protection, "Valuing New Jersey's Natural Capital: An Assessment of the Ecological Value of the State's Natural Resources" (Trenton, 2007), 9–16.

[8] Ibid. 2.

indicates that the amount of farm and industrial land parcels has decreased over time.[9] These and other indicators reveal a change in land use toward a suburban landscape surrounding the Barnegat Bay estuary. Most evidence suggests that sprawling suburban development is far less sustainable than compact development that concentrates its environmental impact over smaller areas.[10]

The Barnegat Bay Watershed and Estuary

Nearly all of the freshwater that enters the Barnegat Bay estuary comes from the bay's watershed (with the exception of direct deposition from rainfall and possible ground-water inflow from the Mullica River watershed).[11] The geology and land cover of the watershed dictate how and to what extent the freshwater enters the bay. Maintaining this complex ecosystem of land and water is a key goal for the *Barnegat Bay 2020* plan.

Geology

The Barnegat Bay watershed is characterized by a relatively flat topography with highly permeable, fine sand soils. The watershed is underlain by the unconfined Kirkwood-Cohansey aquifer, which is the main source of drinking water in Ocean County, as well as the main source of freshwater in the Barnegat Bay estuary. Thirty-two of the thirty-three municipalities in Ocean County use groundwater wells for the public water supply.[12]

"unconfined" aquifer

An "unconfined" aquifer is not constricted by a layer of soil or rock that would inhibit surface water from permeating the aquifer. This means that (1) contaminants in surface water can percolate down into the aquifer and pollute the drinking water supply and (2) contaminants in the groundwater also pollute the Barnegat Bay estuary. Drinking water contamination and contaminated water in Barnegat Bay are directly linked.

Land Cover

Much of the upstream woodlands falls within the New Jersey Pinelands National Reserve and comprises 37 percent of the total watershed area.[13] Here, tracts of land dominated by pitch pine and several oak species are interspersed with "corridors" of hardwood and cedar swamps. This unique habitat supports a rare mixture of mammalian, reptilian, amphibian, and avian communities partially dependent on the unusually nutrient-poor and low-pH waters of the forest. Much of the land within the Pinelands Reserve is private, unprotected land.[14]

[9] Ocean County Board of Taxation, "Ocean County Abstract of Ratables, 2008," www.tax.co.ocean.nj.us/2008LineItems.pdf.

[10] F. Kaid Benfield, Matthew D. Raimi, and Donald D. T. Chen, *Once There Were Greenfields: How Urban Sprawl Is Undermining America's Environment, Economy and Social Fabric* (New York: Natural Resources Defense Council, 1999); Dana Beach, *Coastal Sprawl: The Effects of Urban Design on Aquatic Ecosystems in the United States* (Washington, DC: Pew Oceans Commission, 2002); Robert D. Bullard, Glenn S. Johnson, and Angel O. Torres, "Atlanta Megasprawl," *Forum for Applied Research and Public Policy 4, no. 3* (Fall 1999): 17, 19; Environmental Protection Agency, *The Transportation and Environmental Impacts of Infill Versus Greenfield Development: A Comparative Case Study Analysis* (Washington, DC: Environmental Protection Agency, 1998).

[11] A. D. Gordon, "Hydrology of the Unconfined Kirkwood-Cohansey Aquifer System, Forked River and Cedar, Oyster, Mill, Westecunk, and Tuckerton Creek Basins and Adjacent Basins in the Southern Ocean County Area, New Jersey, 1998–99," U.S. Geological Survey Water Resources Investigations Report 03-4337, 5 plates, 2004.

[12] Workshop Report: Water Supply Issues and Uncertainties in New Jersey's Atlantic Coastal Region (Jacques Cousteau National Estuarine Research Reserve, 1999), 1.
marine.rutgers.edu./pt/coastal_training/resources/workshops/water_supply_workshop.pdf.

[13] U.S. Department of the Interior, National Park Service, "Pinelands National Reserve," www.nps.gov/pine.

[14] Comprehensive Conservation Management Plan, 16.

The lower (including tidal) sections of the watershed are generally characterized by wetlands and tidal areas that historically have provided a natural buffer to rivers and the bay, sheltering inland areas against storms and high winds from the ocean. Conversely, the wetlands also provide an efficient filtration system for pollutants and sediment washed downstream from further inland and can act as a giant sponge during flood events, mitigating the potential damage of the floods by reducing erosion.[15] Further inland, freshwater wetlands, which make up 25 percent of the total watershed, feature two federally listed threatened plant species: swamp pink, and Knieskern's beaked rush.

Protecting the Barnegat Bay Estuary from the open ocean is the Barnegat Bay barrier island complex—the most substantially humanly altered portion of the Barnegat Bay region. The entire island complex has been developed to some extent with the exception of eight miles at Island Beach State Park and three miles at the Holgate Unit of the Edwin B. Forsythe National Wildlife Refuge. The barrier island and dune complex, plus the bay itself, make up the remaining 38 percent of the watershed.[16]

Barnegat Bay Estuary

The Barnegat Bay estuary has a 42-mile-long coastline. The width of the bay ranges from about 1.2 miles to 3.7 miles and has an average tidal-dependent depth of about five feet.[17] The estuary is composed of three microtidal bays (listed from north to south): Barnegat Bay, Manahawkin Bay, and Little Egg Harbor.[18] The estuary is protected from the ocean by a nearly continuous strip of barrier islands through which there are only three inlets for seawater to enter: the man-made Point Pleasant Canal, Barnegat Inlet,[19] and Little Egg Inlet.[20]

Species and Species' Habitat

The bay is bordered by numerous diverse and productive habitats including barrier island, salt marsh, tidal marshes, shallow water, and swamps.

[15] Ibid., 15.

[16] Ibid., 16.

[17] Barnegat Bay National Estuary Program, *Barnegat Bay Estuary Program Characterization Report*, (Toms River, 2001), chapter 2, www.bbep.org/char_rep.html.

[18] *Comprehensive Conservation Management Plan*, 13.

[19] Dutch settlers named the estuary "Barnedegat," or "inlet of breakers," for the rough water they encountered where the estuary meets the open ocean.

[20] *Barnegat Bay Estuary Program Characterization Report*, chapter 4.

The unique habitats of the estuary attract threatened and endangered species (and tourists). A 1997 U.S. Fish and Wildlife Service study called the Barnegat Bay watershed "one of the most important migratory corridors in the hemisphere for shorebirds, passerines, waterfowl, and raptors." The same report listed 156 species of special interest, including 17 federal and state listed threatened or endangered species and species of concern, mostly migrating bird populations and estuarine fisheries populations. Examples include the peregrine falcon and the roseate tern.[21]

Existing wildlife preserves, such as the Forsythe refuge and the Great Bay Boulevard Wildlife Management Area, attract important concentrations of migratory shorebirds and waterfowl, including various species of diving ducks, Canada goose, brant, mallard, bafflehead, American black duck, red knot, dunlin, American oystercatcher, black-bellied plover, piping plover, sanderling, ruddy turnstone, semipalmated sandpiper, least sandpiper, and short-billed dowitcher. These birds are most commonly found in the estuarine mudflats, intertidal beaches, and open waters of the estuary. Migratory raptors, such as hawks and ospreys, are more likely to be found around the barrier islands.[22]

A recent study put the number of fish species in the estuary at about 110. According to the U.S. Fish and Wildlife report, the ten most common fish are bay anchovy, Atlantic silverside, fourspine stickleback, spot, winter flounder, inland silverside, northern pipefish, mummichog, bluefish, and oyster toadfish. The bay anchovy is a primarily estuarine fish that tolerates a wide range of salinities and is found throughout the estuary.[23]

Hydrology

The bay's highest salinity tends to be near the ocean inlets where the tide forces salty ocean waters into the estuary; salinity drops off toward the mainland where fresh waters flow from creeks and rivers. The two larger ocean inlets are in the southern half of the barrier islands although the Point Pleasant Canal also allows saltwater into the north of the bay. Freshwater discharge is greatest from the northern rivers. The highly developed Toms River watershed in the north of the bay provides about a quarter of the overall freshwater input to the estuary.[24]

The small number of inlets that allow ocean water to the bay, and the bay's extreme shallowness

[21] U.S. Fish and Wildlife Service, "Significant Habitats and Habitat Complexes of the New York Bight Watershed," Atlantic Coastal Plain, 6. Barnegat Bay Complex, 1997, training.fws.gov/library/pubs5/begin_newyork_bight.html.

[22] bid., 10.

[23] Ibid., 7; *Comprehensive Conservation Management Plan*, 15; Robert A. Zampella et al., *The Barnegat Bay Watershed: A Report to the Pinelands Commission on the Status of Selected Aquatic and Wetland Resources* (Pinelands Commission: New Lisbon, NJ, 2006).

[24] "Significant Habitats and Habitat Complexes of the New York Bight Watershed," 4.

promotes stagnation of the bay's waters. It can take as long as 70 days during the summer months for water to flush out of the bay. Slow flushing rates accentuate the effects of excess nutrients such as nitrates from fertilizer that have been washed from lawns, especially in summer when fertilizer use is high. The bay is listed as a highly eutrophic (nutrient-rich) estuary by the National Oceanic and Atmospheric Administration.[25]

The average total amount of freshwater (surface water and groundwater) discharged into the estuary is approximately 866 cubic feet per second. Higher discharges occur in the fall and spring.[26] Several large creeks and rivers drain the

watershed into the Barnegat Bay estuary, but most of the water that supplies the streams is derived from groundwater. Annual discharge to the estuary from groundwater, base flow, is between 70 and 90 percent of the total annual discharge from the watershed.[27] During droughts the ratio of groundwater discharge in the estuary increases relative to the amount of surface water runoff, leading to increased importance of sustained groundwater availability.

Contaminated groundwater in the Barnegat Bay watershed does not stay underground but moves into streams, wells, and the bay. Although industrial pollution is largely controlled, household chemical spills, leaks from underground fuel tanks, and other incidents pose a significant risk to the health of the bay ecosystem.

Land Use and Freshwater Quality

Land-use patterns affect both surface and groundwater quality. Samplings by the U.S. Geological Survey and others show that volatile organic compounds and heavy metal concentrations are greatest in the Toms River and Metedeconk River basins, the two most heavily developed portions of the Barnegat Bay watershed.[28] Toxic chemicals in surface water and groundwater, such as volatile organic compounds, heavy metals, and oil derivatives, are found in the highest concentrations near commercial/industrial areas such as gas stations, factories, and dry-cleaning operations. In general, land uses that can affect the quality of the water supply include (1) residential and commercial land maintenance, (2) land in-filling, (3) farming, (4) ditching to drain mosquito breeding areas, (5) stream channelization, and (6) stream impoundment (dams). Nitrate and phosphate concentrations in groundwater wells and streams are greatest near farms and highly fertilized lawns.

[25] Michael J. Kennish et al., "Barnegat Bay-Little Egg Harbor Estuary: Case Study of a Highly Eutrophic Coastal Bay System," *Ecological Applications* 17, no. 5, Supplement (2007): S3.

[26] *Comprehensive Conservation Management Plan*, 14–15.

[27] Christine M. Wieben, *Assessment of a Shallow Ground-Water-Quality Indicator* (Barnegat Bay National Estuary Program and U.S. Geological Survey, 2007), 4–6.

[28] Michael J. Kennish, "State of the Estuary and Watershed: An Overview," *Journal of Coastal Research*, no. 32, 2001, 248–249.

Barnegat Bay's Water Quality

The most visible side effect of development is the harm caused by runoff of fertilizers from lawns and farms, which is carried by streams and rivers into Barnegat Bay (this runoff is an example of what is known as non-point source pollution). High levels of phosphorus and other nutrients from fertilizers create an unnatural boom in plant and algal production, which in turn produces abnormal levels of oxygen in the water of streams and lakes as well as the bay. Conversely, when the plants and algae die, the decay process reduces the amount of oxygen. These wide variations in oxygen levels can cause massive fish kills and make habitats unsuitable for plant and animal life. Similarly, algal blooms caused by nutrient pollution, or eutrophication, can prevent sunlight from reaching the benthic communities (bottom-dwelling plants and animals) that rely on the sun's energy. This is extremely damaging because benthic communities are the estuary's "backbone," forming a baseline energy source for animals further up the food chain.

Algal blooms also harm the Barnegat Bay estuary by blocking light to eelgrass and other plants. These grasses are in steep decline and are being replaced by invasive species. A host of finfish, shellfish, and waterfowl are dependent on eelgrass and other plants that once thrived in the bay's sunlight-rich and brackish waters.

According to one report, about 29 percent of the nutrient pollution in Barnegat Bay is from organic nitrogen found in residential and commercial fertilizers. Approximately 71 percent of the non-point source pollutants derive from runoff from industrial and urban lands. Since 1980 all Ocean County sewage has been discharged offshore, but the exact effect this may have on nutrient pollution of the bay is unknown.[29] Eutrophication appears to

be directly related to the type and intensity of development within the Barnegat Bay watershed and is worse in the highly developed northern section of the bay around the Metedeconk River than near the southern, less developed section of the watershed.[30]

The Trust for Public Land's Role

The Trust for Public Land (TPL) first became involved in the Barnegat Bay region in 1985.[31] A decade later, TPL commissioned *The Century Plan*, a comprehensive report on some of the natural resources within the watershed. It was both a citizens' guide to the extraordinary flora and fauna of

the area and a regional conservation "greenprint," which identified 100 undeveloped land parcels as high priorities for public access and conservation of the region's unique resources. The report's focus on the aesthetic and ecological riches of the Barnegat

[29] Yuan Goa, Michael J. Kennish, and Amanda McGuirk Flynn, "Atmospheric Nitrogen Deposition to the New Jersey Coastal Waters and Its Implications," *Ecological Applications* 17, no. 5, Supplement (2007): S31.

[30] Kennish et al., "Barnegat Bay-Little Egg Harbor Estuary: Case Study of a Highly Eutrophic Coastal Bay System," S3.

[31] Peter P. Blanchard III, *The Century Plan: A Study of One Hundred Conservation Sites in the Barnegat Bay Watershed* (New York: The Trust for Public Land, 1995), 4.

Bay watershed raised public awareness of how conservation could play a significant role in improving and protecting a healthy bay ecosystem.

The Century Plan identified 75,930 acres for conservation. Since then, 23,677 acres have been protected, and 47,226[32] original *Century Plan* acres may remain undeveloped and unprotected. Of that latter sum, 16,360[33] acres are identified as high priority on the new parcel map explained on page 27. This new map also identifies thousands of additional acres that reflect good opportunities for voluntary conservation to meet community goals.

In 1997 TPL published *Beyond the Century Plan*, which detailed results of an ecological inventory performed by scientists in conjunction with a Geographic Information Systems–based "gap analysis" of the watershed to identify land parcels to set aside for conservation. Both the 1995 and 1997 TPL reports identified potential conservation properties based on the ecological and aesthetic significance of the land. The studies did not address the connection between land use, the downstream movement of pollutants, and the overall health of the ecosystem and safety of the drinking water supply. Many scientific reports now directly tie developed land with elevated levels of pollutants both near the developed areas and downstream from the development.[34]

[32] Again, because 2002 land cover data were used, this figure underrepresents the amount of land lost to development because it does not reflect change in the last six-plus years. The actual number of *Century Plan* acres that remain undeveloped and unprotected is lower than the number given here.

[33] This figure is the number of acres of nonurban, unprotected *Century Plan* sites that were prioritized in at least one of the four thematic goals developed by the steering committee.

[34] Kennish, "State of the Estuary and Watershed: An Overview," 243.

The Regulatory Framework

State and Federal Regulations

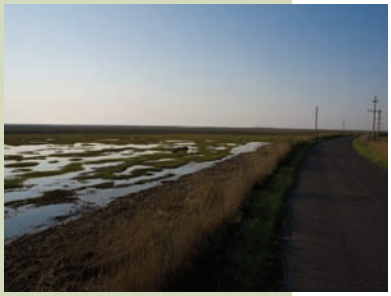
Numerous governmental agencies and nongovernmental organizations are dedicated to protecting the health of the Barnegat Bay watershed, resulting in a complicated web of acronym-heavy regulatory and special-interest programs. Land-use regulation in the watershed falls under several regional programs that are managed by the New Jersey Department of Environmental Protection (NJDEP) and the New Jersey Pinelands Commission.

The NJDEP's Surface Water Quality Standards program gives special protection to crucial headwaters and reservoirs under a three-level classification system. Water bodies that have exceptional water quality significance—such as those that serve as sources of drinking water, support habitat for species that are endangered or threatened, or provide recreational or commercial uses—may receive Category 1 status (C-1). In C-1 areas, there are restrictions governing new or proposed changes to activities that will potentially lower water quality. In the Barnegat Bay region, the entire Metedeconk River watershed, from the headwaters in Freehold, Millstone, and Jackson down to Forge Pond along State Highway 70 in Brick, has been designated a C-1 waterway owing to its exceptional water supply significance. Portions of Toms River were designated C-1 in June, 2008.[35]

The U.S. Congress established the 1.1-million-acre Pinelands National Reserve—the first such designation—in 1978. State law designates most of the reserve as either natural resource preservation areas, or as buffer zones where growth is controlled.

In the western Pinelands portion of the Barnegat Bay watershed, the state's Pinelands Commission regulates land use to protect water quality and historical resources. For example, the Pinelands Comprehensive Management Plan requires affected counties and municipalities to submit land-use plans that adhere to strict zoning and smart-growth guidelines.[36]

The Coastal Area Facility Review Act (CAFRA) governs all of the land use east of the Pinelands region in the watershed (roughly bordered by the Garden State Parkway). Regulations affecting development increase with proximity to the coast as determined by distinct zones described in the CAFRA legislation.[37] In addition, a portion of this area falls within the Pinelands National Reserve, and development applications are reviewed and commented on by the Pinelands Commission.



Shoreline waterways are regulated by laws under the New Jersey Tidelands Act. Wetlands are regulated by the state's Wetlands Act of 1970. These laws restrict development within the tidal portion of the watershed, including land that is no longer tidal, but that was tidal at one point, such as wetlands that have been in-filled with dirt and other materials for development.

[35] *Round 5 Category 1 Proposal*, New Jersey Department of Environmental Protection, May 21, 2007. See also NJDEP's Water Monitoring and Standards web page for information on the program and posted updates, www.state.nj.us/dep/wms/bwqsa/swqshome.html.

[36] Pinelands Commission Land Use and Planning, 2008, www.state.nj.us/pinelands/landuse/.

[37] New Jersey Department of Environmental Protection, Division of Land Use and Regulation, Coastal Area Facility Review Act, 2008, www.state.nj.us/dep/landuse/coast.html.

The Barnegat Bay National Estuary Program

In 1995, the same year that TPL released The *Century Plan*, the Barnegat Bay watershed was designated the 28th National Estuary under the U.S. EPA's National Estuary Program. By definition, these water bodies are threatened "estuaries of national significance." Barnegat Bay National Estuary Program (BBNEP) staff were hired and charged with producing a science-based comprehensive plan to prevent activities that harm (1) the public water supply, (2) shellfish, fish, and wildlife populations, and (3) recreational opportunities. The BBNEP plan, released in 2001, does not set regulations but is advisory, and it is to be used to help prioritize funding decisions. The BBNEP is responsible for developing "action plans" to identify and fund organizations that promote the agenda of the comprehensive plan.[38] There are four main areas of focus: (1) water quality and water supply, (2) habitat and living resources, (3) human activities and competing uses, and (4) public participation and education. Generally, the BBNEP intends to use these categories to fund programs run by nonprofit organizations, governmental groups, and others that can provide tangible, quantifiable results that are complimentary to the broad goals of the comprehensive plan.

Local Laws

Amid this complex regulatory fabric of management plans, local governments have enacted ordinances to protect the bay's water quality. These ordinances vary in approach but collectively represent a strong commitment to guarding water resources and recognition that no single approach is adequate.

Local regulatory mechanisms generally include some of the following:

- Zoning overlays for water bodies with special development restrictions (e.g., wellhead protection overlay zones; special protection of water bodies is also afforded through the NJDEP Surface Water Quality Standards)
- Mandates for soil erosion control programs for construction sites (see also the New Jersey Soil Erosion and Sediment Control Act)
- Development restrictions within floodplains
- New, stricter New Jersey stormwater requirements for quality and retention[39]
- Bans on illicit discharges and connections to the storm sewer system, where applicable

New Jersey's Office of Smart Growth offers municipalities the opportunity to receive State Planning Commission endorsement of their master plans for compliance with appropriate state regulatory programs. Grants and funding programs are incentives to participate in the process, which can assure appropriate designation of preservation areas.

[38] *Comprehensive Conservation Management Plan*, 3–9.

[39] See, for example, Stafford Township Municipal Code, Stormwater Control s.130-76 (D)(7)(a): "Stormwater management measures shall be designed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm by 80 percent of the anticipated load from the developed site, expressed as an annual average.... The water quality design storm is 1.25 inches of rainfall in two hours." Stafford has also set limits for total impervious surface in each building zone in the township and requires a permit for installation of postdevelopment impervious surfaces (Ordinance No. 2007-33 and Ordinance No. 2007-34).

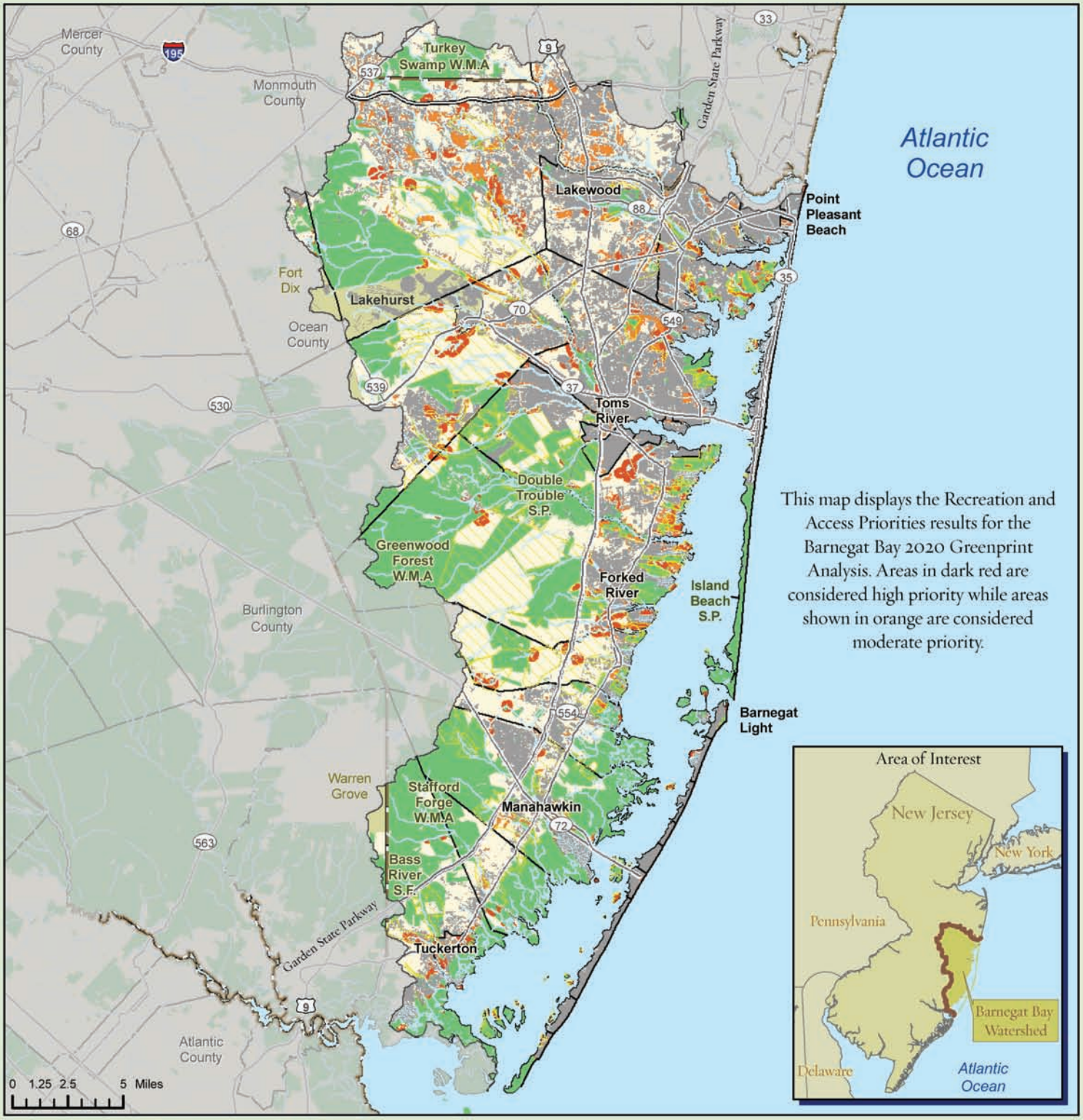
Barnegat Bay Visual Analyses

The following eight pages contain maps of the Barnegat Bay watershed, described in detail in the *Barnegat Bay 2020* Goals section beginning on page 25.

These maps and other information are also available on The Trust for Public Land's website: tpl.org/barnegatbay

Map 1

Barnegat Bay 2020
Recreation and Access Priorities



Recreation and Access Priorities
- High
- Moderate

- Protected Land*
- Urban
- Century Plan Site
- Military Installation
- Water

- Interstate
- Highway
- Municipal Boundary
- County Boundary

*Protected Land includes areas managed by the U.S. Fish and Wildlife Service, New Jersey Natural Lands Trust , Ocean County Natural Lands Trust, The Nature Conservancy, New Jersey Conservation Foundation, parcels within the Pinelands development credit areas, county and township parks and county conservation easements as well as New Jersey Department of Environmental Protection lands which include wildlife management areas, state forests, and state parks.

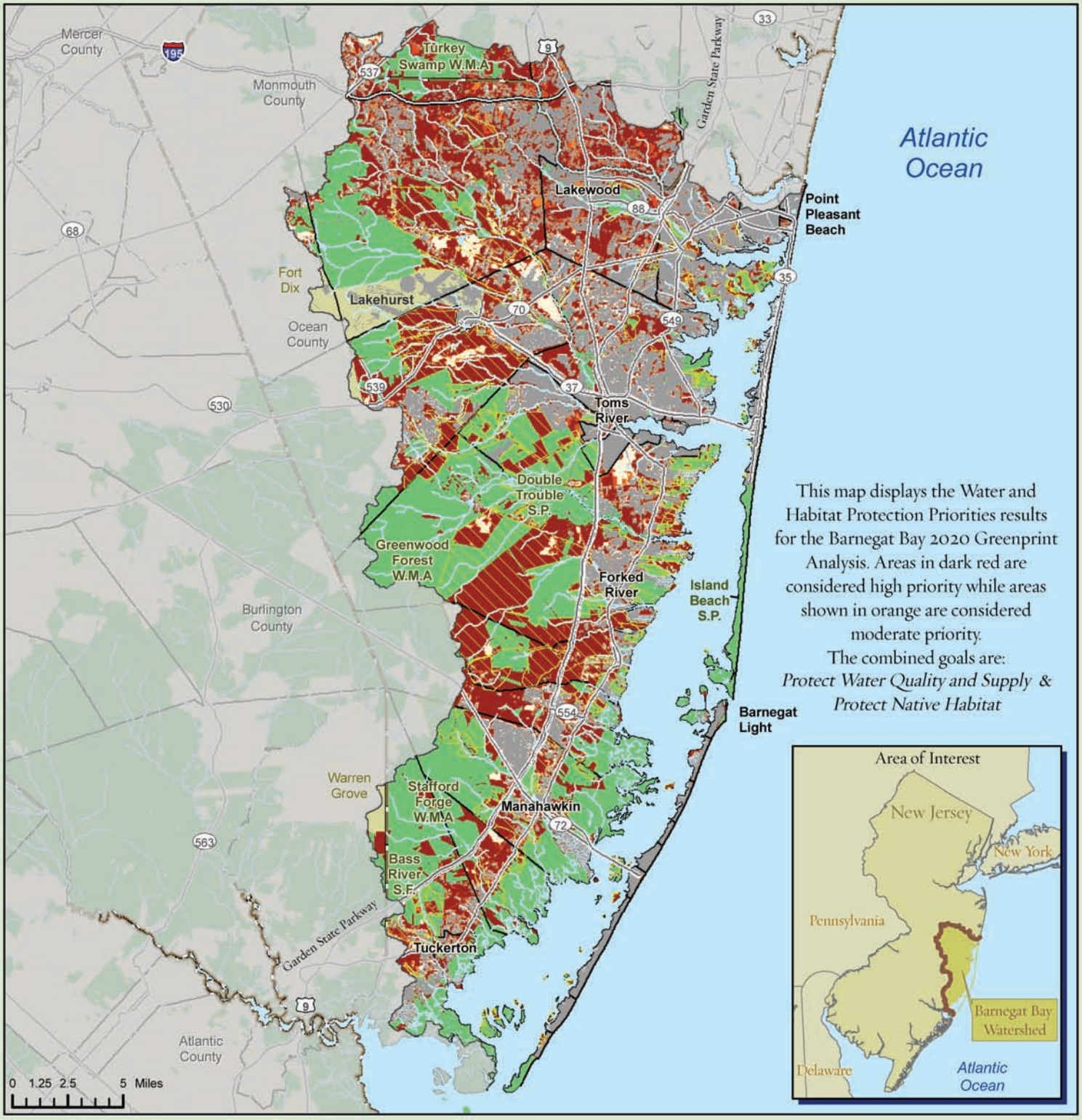
Map created by The Trust for Public Land on May 19, 2008

Created in ArcMap 9.2®
Map Projection: NAD 1983 State Plane New Jersey FIPS 2900 Feet

Information on this map is provided for purposes of discussion and visualization only.

Map 2

Barnegat Bay 2020
Water and Habitat Protection Priorities



This map displays the Water and Habitat Protection Priorities results for the Barnegat Bay 2020 Greenprint Analysis. Areas in dark red are considered high priority while areas shown in orange are considered moderate priority.
The combined goals are:
Protect Water Quality and Supply & *Protect Native Habitat*

Water and Habitat Protection Priorities

- High
- Moderate
- Protected Land*
- Urban
- Century Plan Site
- Military Installation
- Water
- Interstate
- Highway
- Municipal Boundary
- County Boundary

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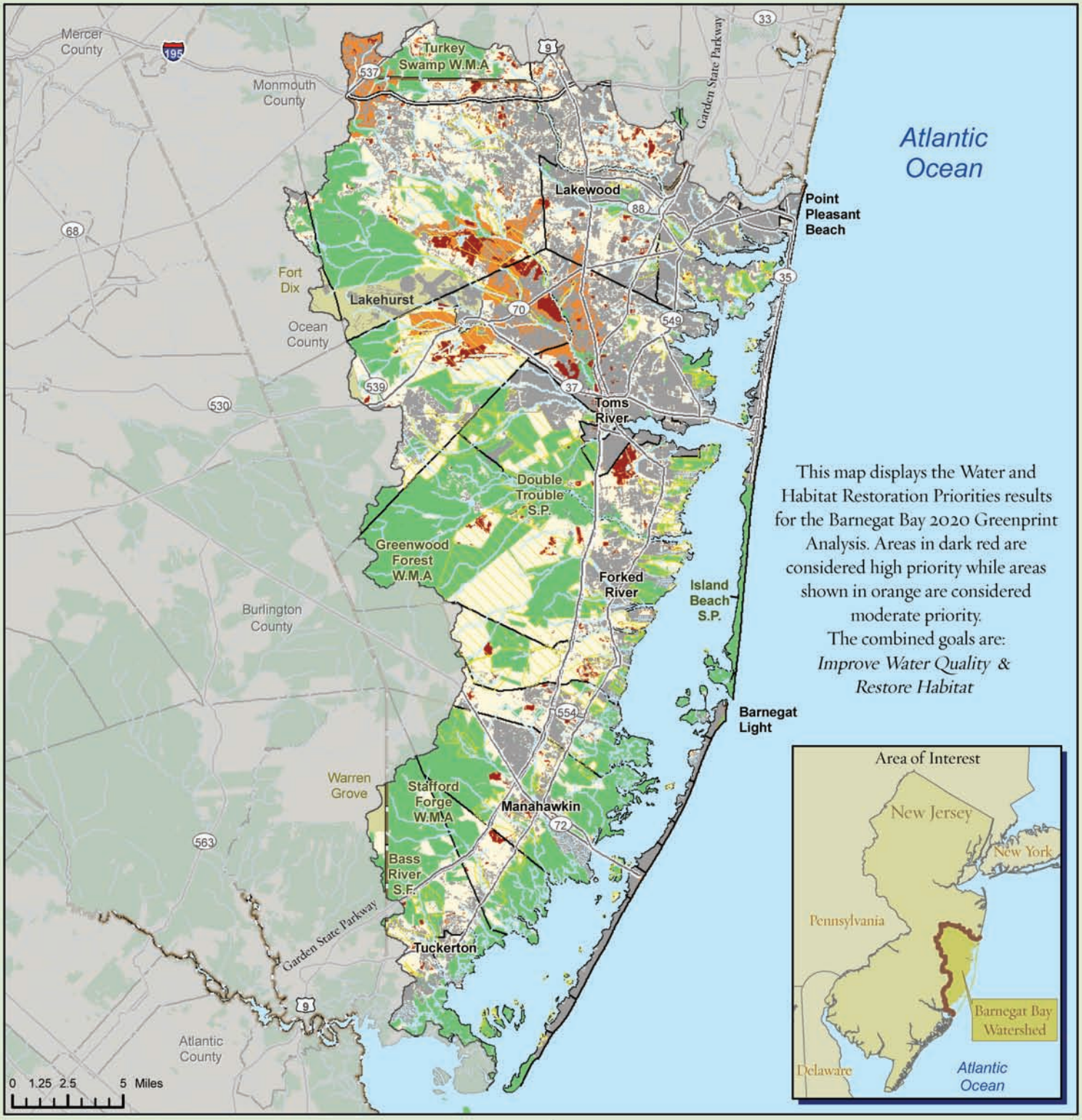
Map 3

Barnegat Bay 2020
Water and Habitat Restoration Priorities



Water and Habitat Restoration Priorities

- High
- Moderate

- Protected Land*
- Urban
- Century Plan Site
- Military Installation
- Water

- Interstate
- Highway
- Municipal Boundary
- County Boundary

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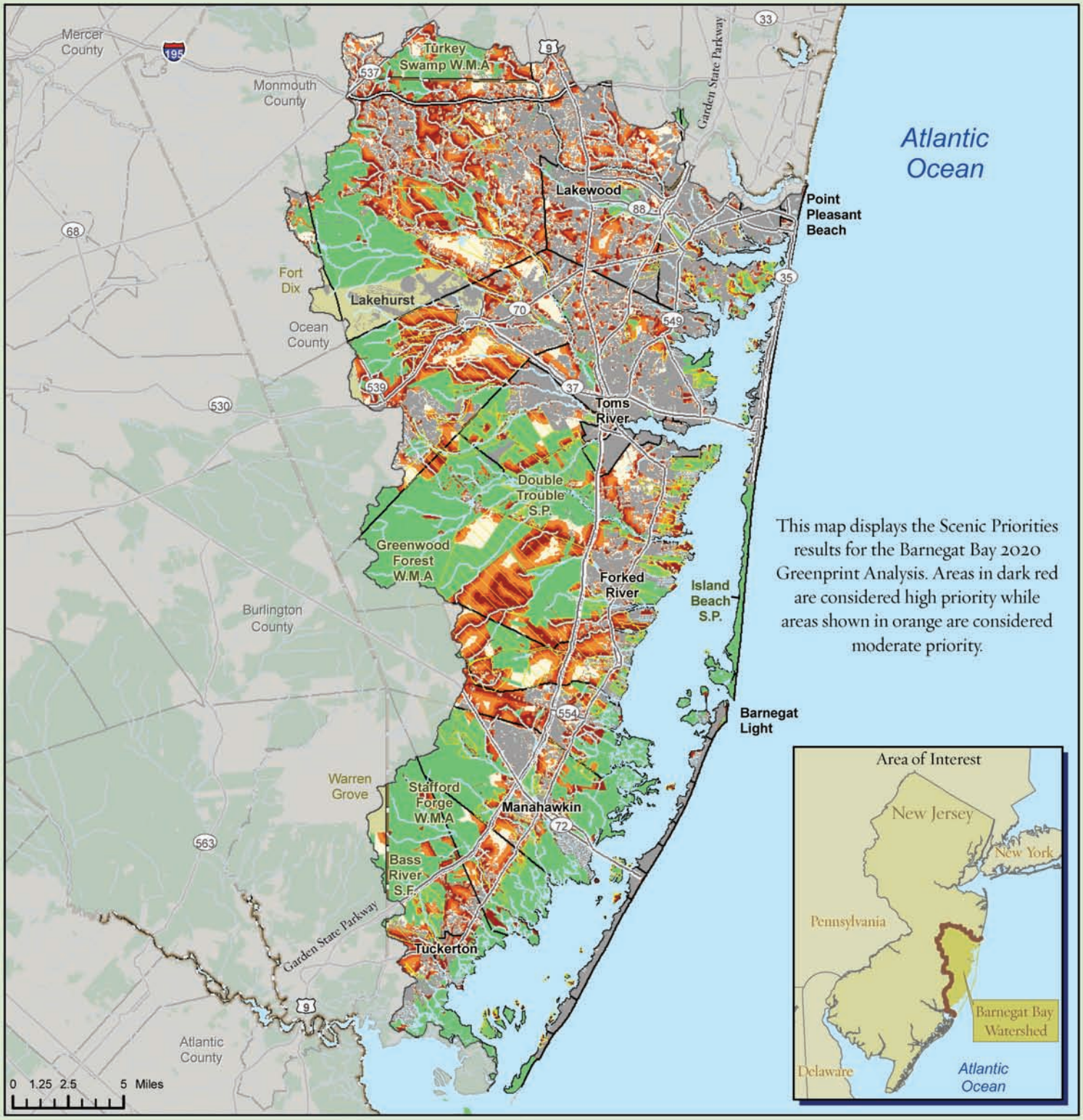
Map 4

Barnegat Bay 2020
Scenic Priorities



Scenic Priorities

- High
- Moderate
- Protected Land*
- Urban
- Century Plan Site
- Military Installation
- Water
- Interstate
- Highway
- Municipal Boundary
- County Boundary

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Map created by The Trust for Public Land on May 19, 2008

Created in ArcMap 9.2®
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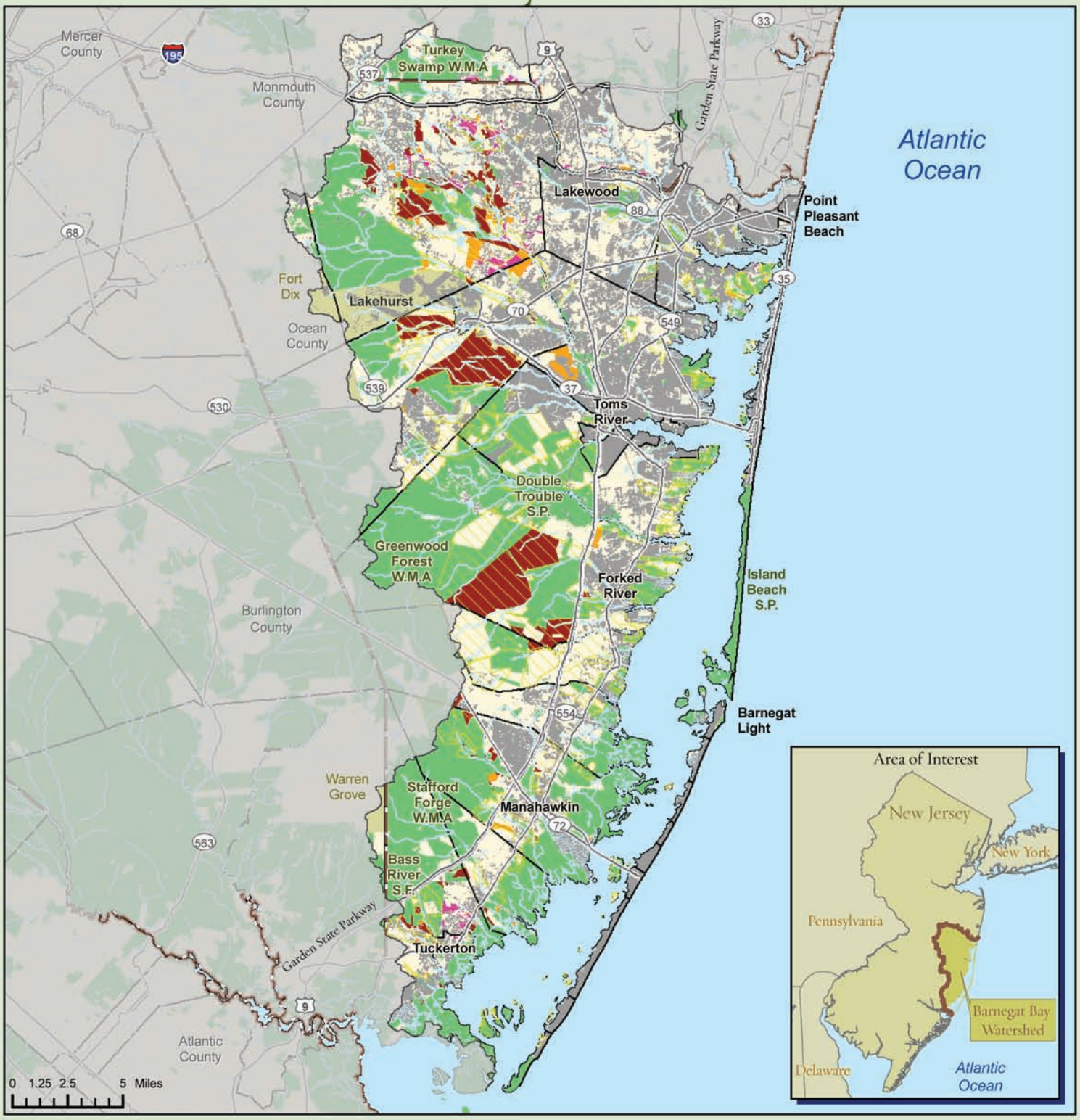
Map 5

Barnegat Bay 2020 Priority Parcels



Priority Parcels

- Protection Priorities
- Recreation Priorities
- Restoration Priorities
- Scenic Priorities
- Protected Land*
- Urban
- Century Plan Site
- Military Installation
- Water
- Interstate
- Highway
- Municipal Boundary
- County Boundary

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Map created by The Trust for Public Land on May 19, 2008

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Map Projection: NAD 1983 State Plane New Jersey FIPS 2900 Feet

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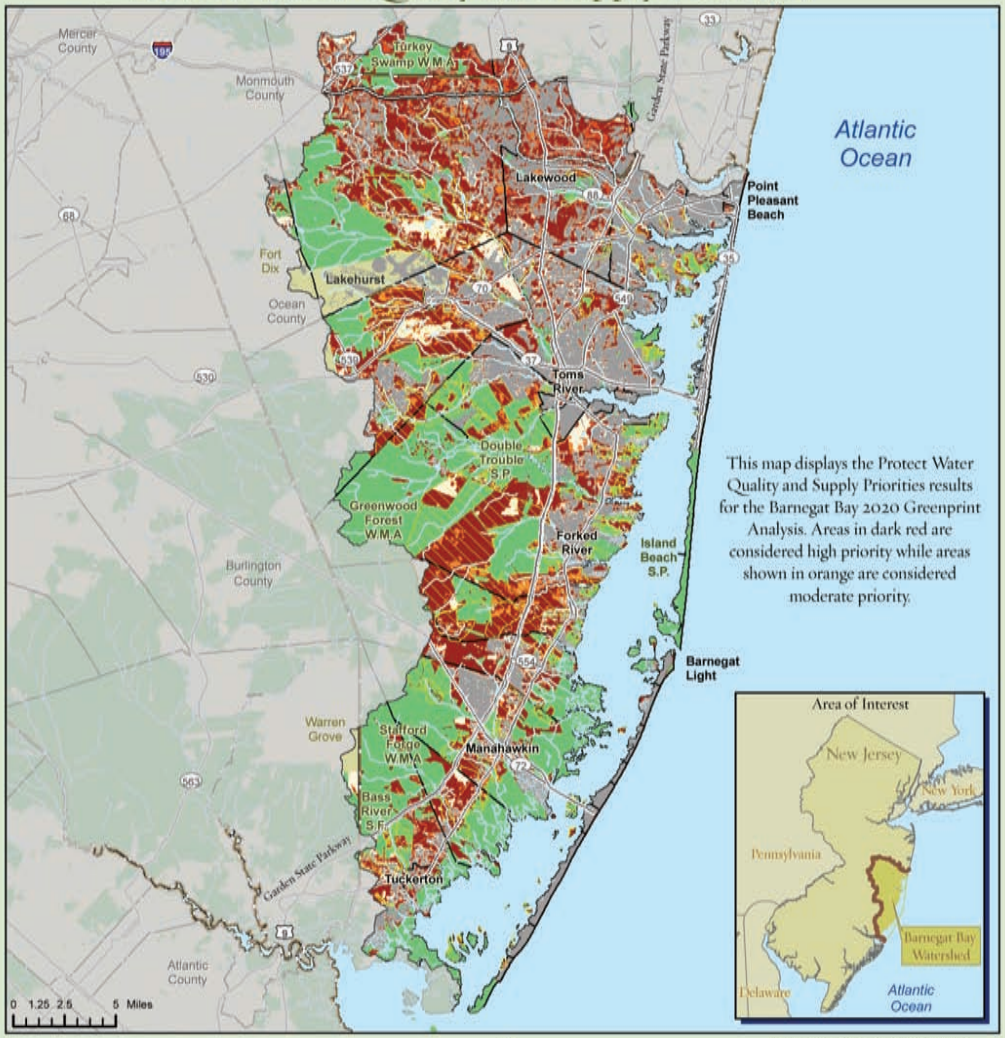
Barnegat Bay 2020
Protect Water Quality and Supply Priorities



This map displays the Protect Water Quality and Supply Priorities results for the Barnegat Bay 2020 Greenprint Analysis. Areas in dark red are considered high priority while areas shown in orange are considered moderate priority.

Protect Water Quality and Supply
- High
- Moderate
- Protected Land*
- Urban
- Century Plan Site
- Military Installation
- Water
- Interstate
- Highway
- Municipal Boundary
- County Boundary

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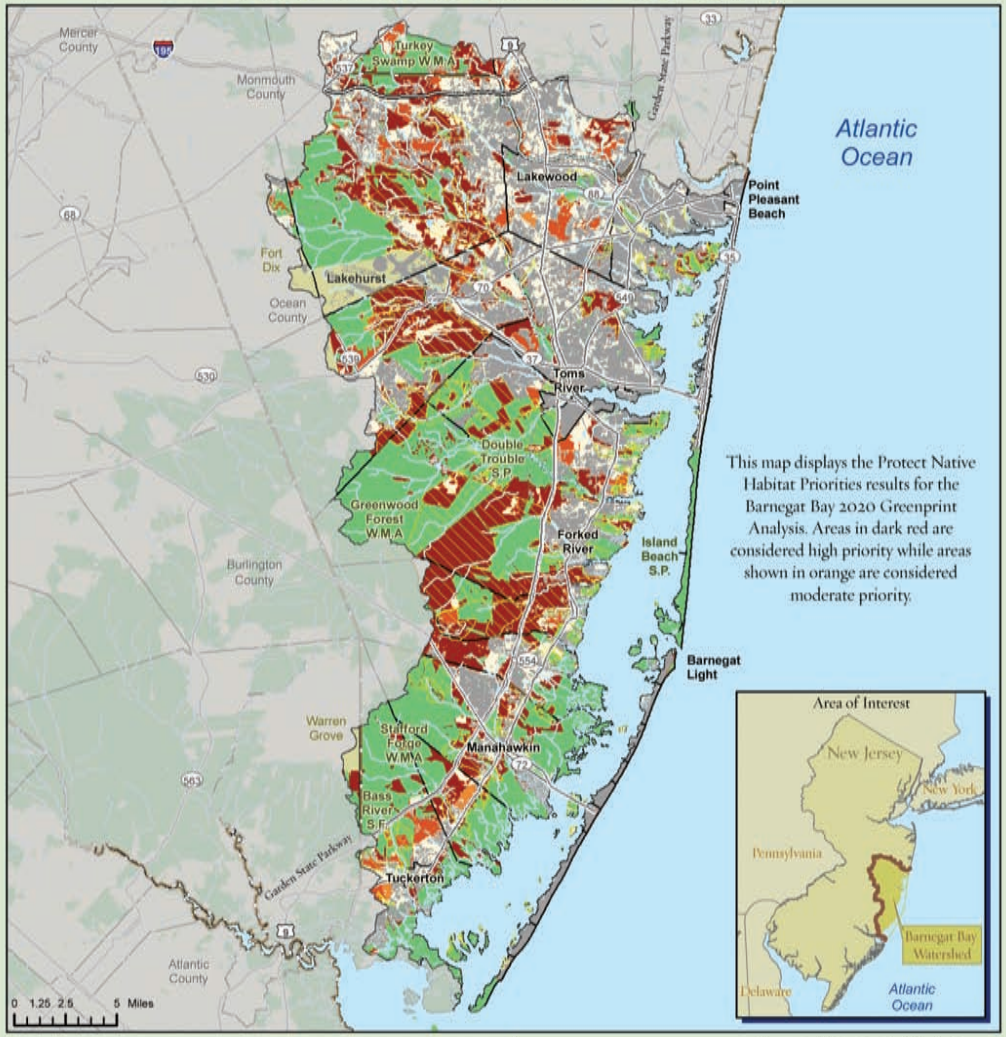
Barnegat Bay 2020
Protect Native Habitat Priorities



This map displays the Protect Native Habitat Priorities results for the Barnegat Bay 2020 Greenprint Analysis. Areas in dark red are considered high priority while areas shown in orange are considered moderate priority.

Protect Native Habitat Priorities
- High
- Moderate
- Protected Land*
- Urban
- Century Plan Site
- Military Installation
- Water
- Interstate
- Highway
- Municipal Boundary
- County Boundary

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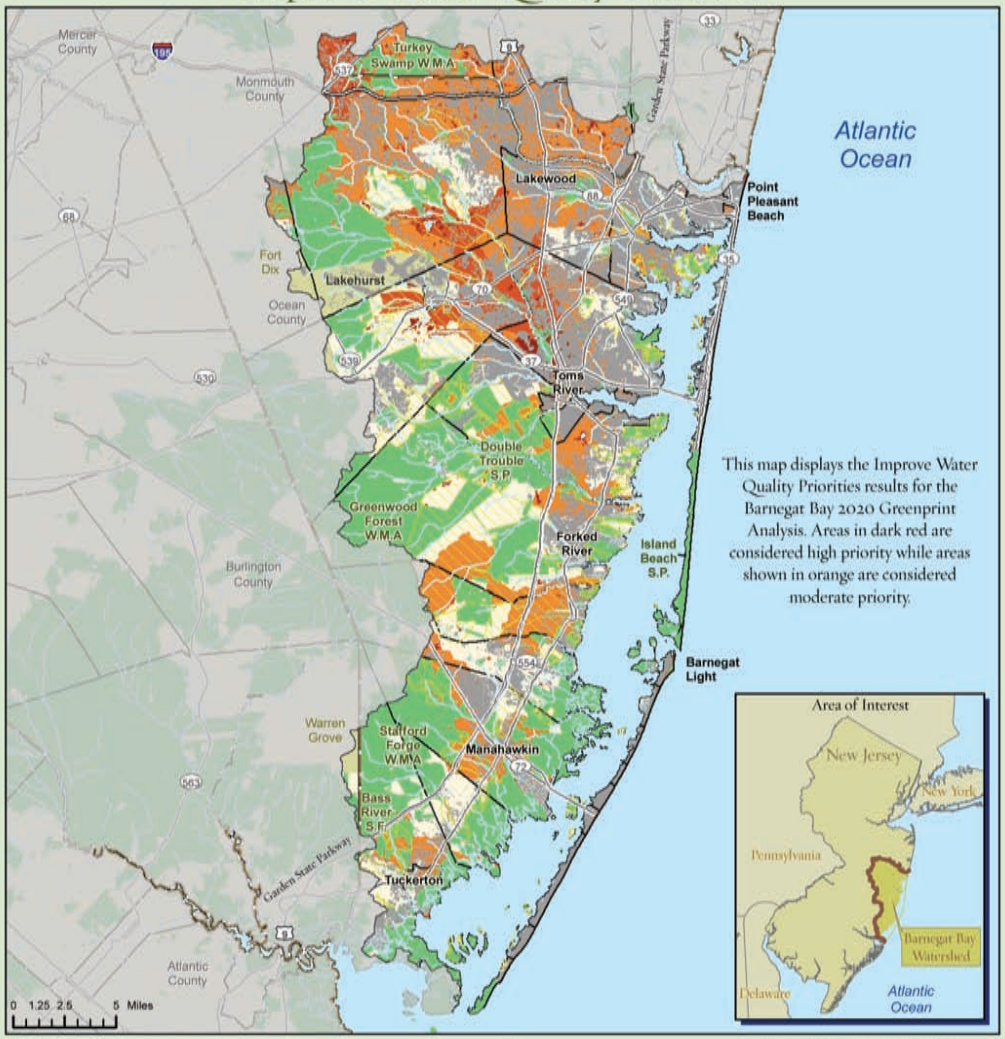
Barnegat Bay 2020
Improve Water Quality Priorities



This map displays the Improve Water Quality Priorities results for the Barnegat Bay 2020 Greenprint Analysis. Areas in dark red are considered high priority while areas shown in orange are considered moderate priority.

Improve Water Quality

Priorities
- High
- Moderate

- Protected Land*
- Urban
- Century Plan Site
- Military Installation
- Water
- Interstate
- Highway
- Municipal Boundary
- County Boundary

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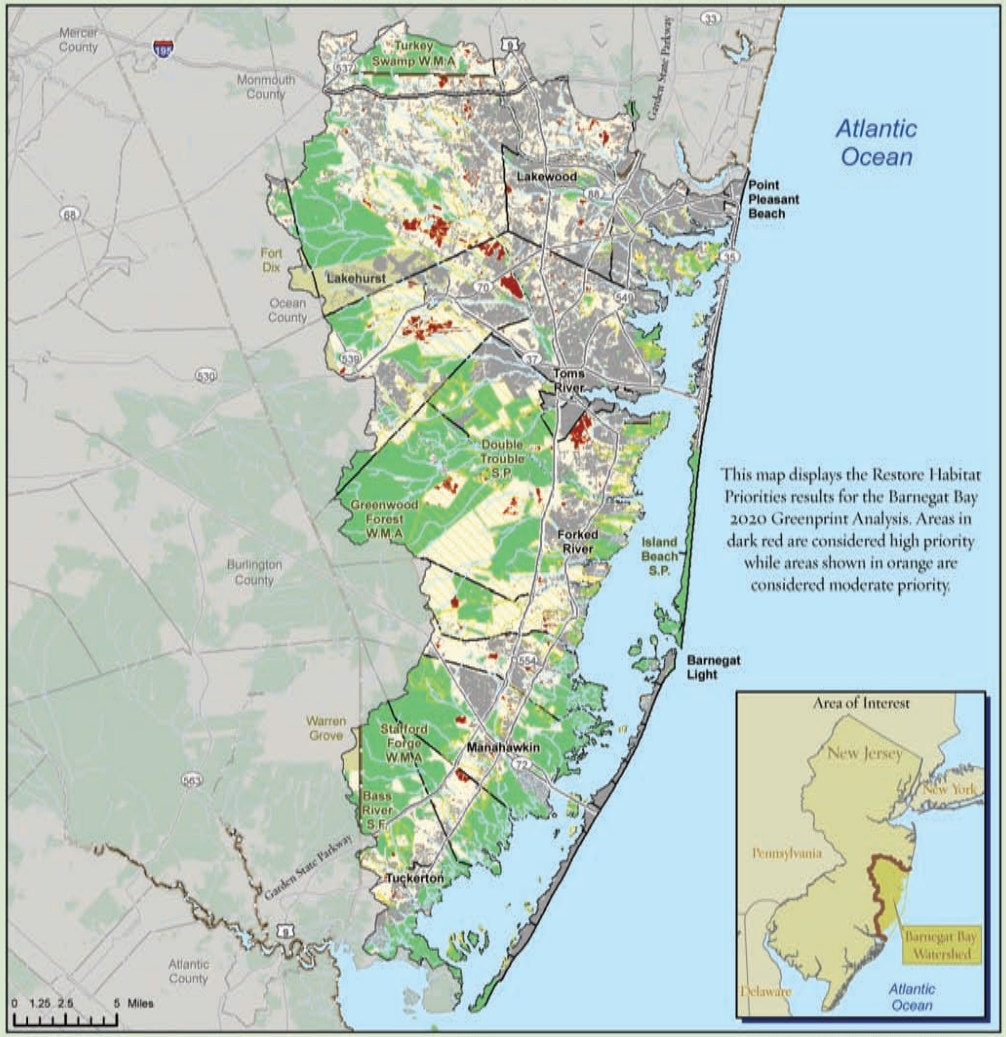
Map created by The Trust for Public Land on May 19, 2008

Created in ArcMap 9.2®
Map Projection: NAD 1983 State Plane New Jersey FIPS 2900 Feet

Barnegat Bay 2020
Restore Habitat Priorities



This map displays the Restore Habitat Priorities results for the Barnegat Bay 2020 Greenprint Analysis. Areas in dark red are considered high priority while areas shown in orange are considered moderate priority.

Restore Habitat

Priorities
- High
- Moderate

- Protected Land*
- Urban
- Century Plan Site
- Military Installation
- Water
- Interstate
- Highway
- Municipal Boundary
- County Boundary

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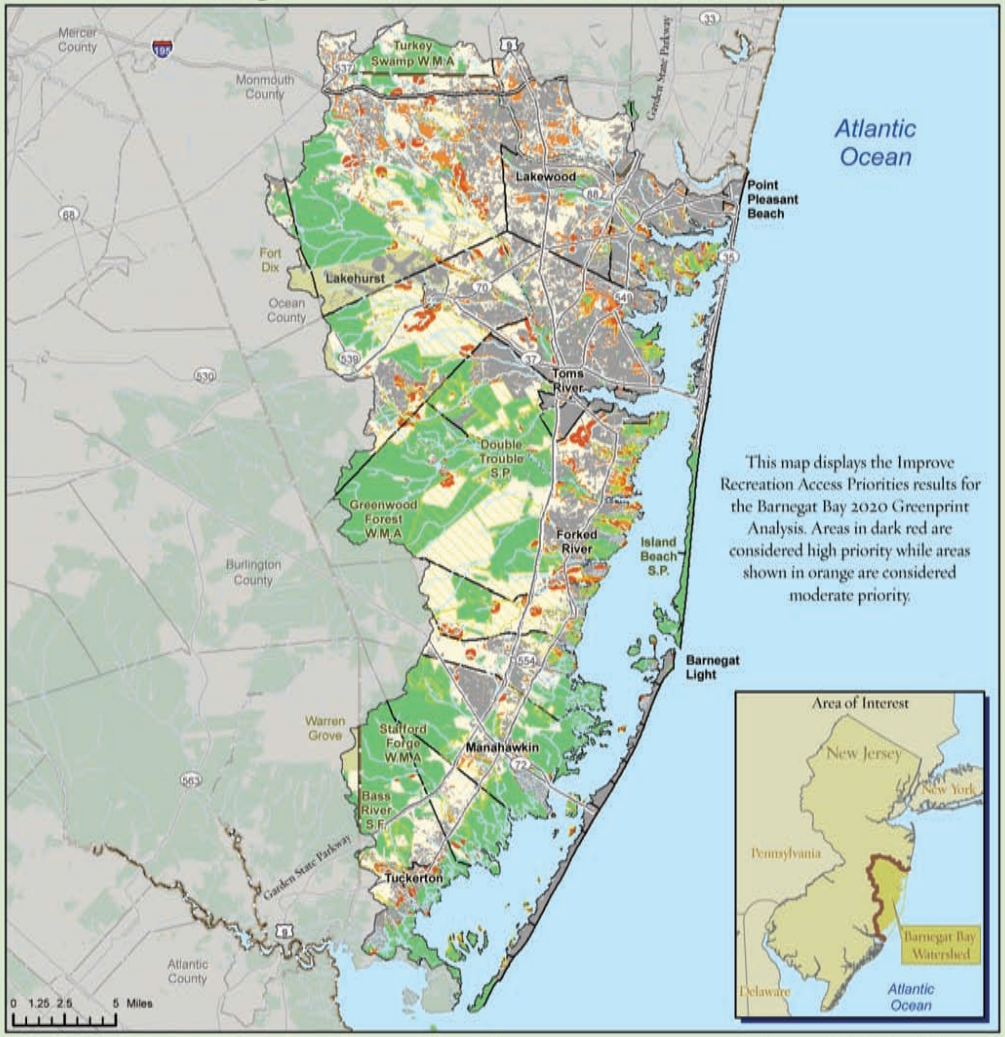
Map created by The Trust for Public Land on May 19, 2008

Created in ArcMap 9.2®
Map Projection: NAD 1983 State Plane New Jersey FIPS 2900 Feet

Barnegat Bay 2020
Improve Recreation Access Priorities



This map displays the Improve Recreation Access Priorities results for the Barnegat Bay 2020 Greenprint Analysis. Areas in dark red are considered high priority while areas shown in orange are considered moderate priority.

Improve Recreation Access Priorities

- High
- Moderate
- Protected Land*
- Urban
- Century Plan Site
- Military Installation
- Water
- Interstate
- Highway
- Municipal Boundary
- County Boundary

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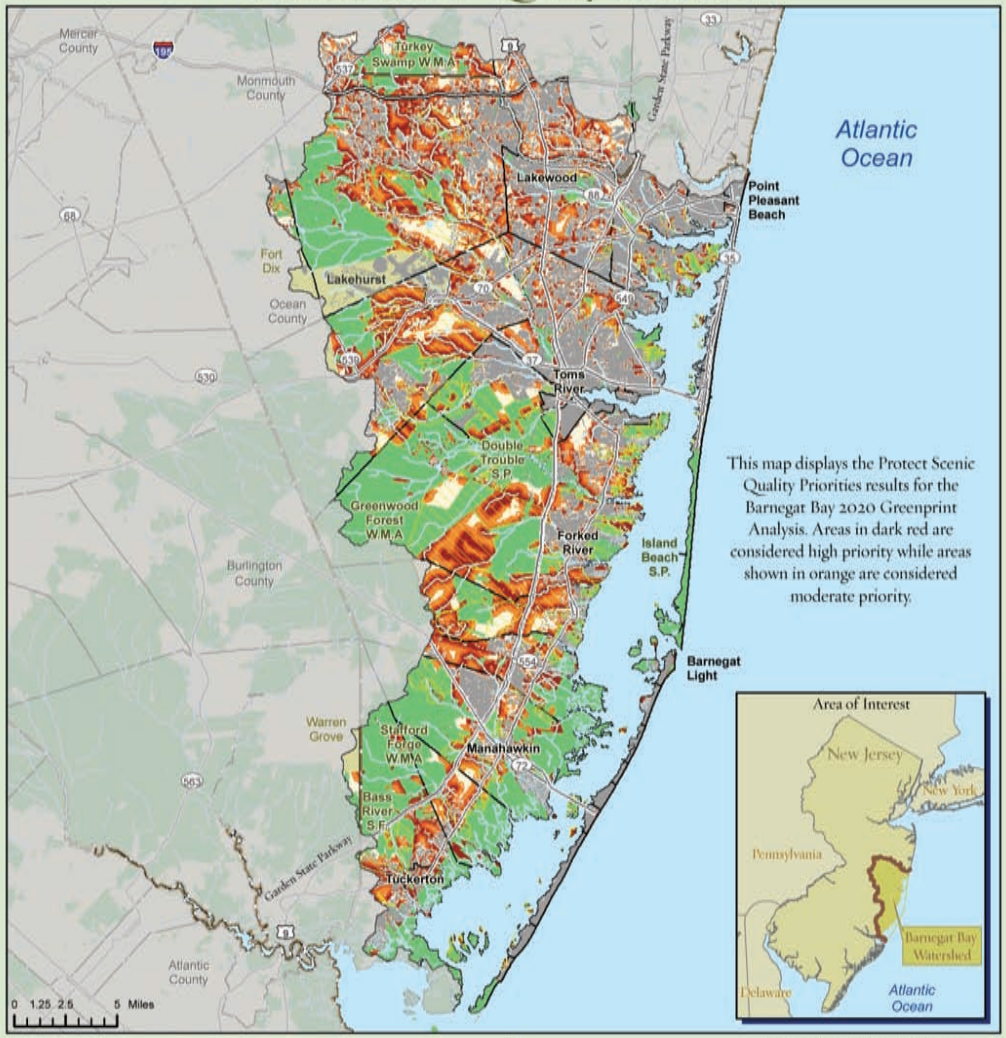
Barnegat Bay 2020
Protect Scenic Quality Priorities



This map displays the Protect Scenic Quality Priorities results for the Barnegat Bay 2020 Greenprint Analysis. Areas in dark red are considered high priority while areas shown in orange are considered moderate priority.

Protect Scenic Quality Priorities

- High
- Moderate
- Protected Land*
- Urban
- Century Plan Site
- Military Installation
- Water
- Interstate
- Highway
- Municipal Boundary
- County Boundary

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Voluntary Mechanisms

Besides utilizing regulatory tools, local governments can buy parcels from landowners for conservation purposes. This approach has a variety of benefits. First, it gives governments, citizens, and concerned groups a way to meet regional plan goals while also responding to concerns about regulation and property values. Second, regulations can be changed, amended, dropped, or adapted as political climates change, but land protection, if done properly, lasts into perpetuity. Third, to be effective, regulations must be enforced, yet enforcement varies tremendously from place to place.

Ocean County credits TPL's *Century Plan* with providing the initial motivation to develop an open space plan by raising public awareness of the economic and ecological value of the remaining natural lands within the watershed. In 1997 dedicated Ocean County residents voted to increase their property taxes by 1.2 cents per $100 of total real estate valuation. This revenue funds the Ocean County Natural Lands Trust Fund Program, which purchases land to "1) maintain the rural character of the county; 2) protect critical environmental resources; 3) maintain active agriculture; and 4) buffer areas that are not compatible with development."[40] As of the beginning of 2008, the Ocean County Natural Lands Trust Program had acquired 6,830 acres, of which at least 1,750 acres TPL was involved in helping to purchase.[41] NJDEP's Green Acres Program—a state program that gives competitive grants to counties and municipalities to help facilitate land acquisition—has been an important source of matching funds for many of these transactions.

Recent GIS Analysis Reveals the Need to Act Now

Using Geographic Information Systems (GIS), a Rutgers University team in 1999 published a report on the nature of land-use change within the Barnegat Bay watershed. The analysis showed how development has affected the watershed over time and where best to focus on protecting land. A habitat map was constructed that broke the watershed into 36 habitat subcategories and clearly located vital habitats as well as habitats that are threatened by development.

The report, and a recent update by the same authors, make these points:[42]

> As of 2006, 33 percent of the watershed was developed, up from 28 percent in 1995 and 18 percent in 1972. Most of the development is focused in the northeast and barrier island portions of the watershed. At the same time, the GIS analysis clearly connects the subwatersheds of the Toms and Metedeconk rivers, the two highest-discharging rivers in the bay watershed, with the most developed areas.
>
> As much as 20 percent, or 33,853 acres, of the upland Pine Barrens forest and as much as 6 percent, or 4,633 acres, of wetlands were lost between 1972 and 1995.
>
> About 20 percent of all riparian corridors are "altered." Riparian corridors are defined as the space 295 feet on each side of streams of a certain size. The analysis shows that riparian corridors are more altered in the developed northeast region of the watershed than elsewhere. Because riparian corridors are vital for filtering surface water and groundwater, the loss of riparian corridors in developed areas can mean that pollutants will more easily enter the groundwater and streams.

[40] Ocean County Natural Lands Trust Fund Advisory Committee, *Ocean County Open Space and Recreation Inventory* (Ocean County Board of Chosen Freeholders, 2001), 1-4.

[41] Correspondence with McKeon.

[42] Kirk Moore, "Watershed Development Jeopardizes Bay Life," *Asbury Park Press*, November 28, 2007; Richard G. Lathrop, Jr. et al., "Data Synthesis Effort for the Barnegat Bay Estuary Program: Habitat Loss and Alteration in the Barnegat Bay Region," 1999, www.crssa.rutgers.edu/projects/runj/habalt1.html. Information for this section was taken directly from the web site with little adaptation.

About 71 percent of the Barnegat Bay shoreline is developed or "altered," bulkheading being a significant problem. Shoreline buffers are defined in this study as areas that would fall along the intertidal and mudflat portions of the estuary, areas that are vital to the estuary's birds and other animals.

Development has eliminated over 28 percent of the bay's salt marshes. Much of the bay's salt marsh system was destroyed by mosquito control ditching and development built on wetlands that were filled and then dredged to form waterfront lots on mazes of lagoons before 1970.

The extent of submerged aquatic vegetation in the estuary may have decreased as much as 20 percent between 1979 and 1998. This could be a direct indication that nutrient pollution is harming this vital habitat.

As of 1999, there were still key resources not yet in some form of public conservation ownership: 10 percent of Barnegat Bay's salt marshes, 30 percent of the remaining undeveloped shoreline, 55 percent of interior forest habitat, and 50 percent of Barnegat Bay's islands.

GIS

GIS (Geographic Information Systems) analysis uses satellite photos, aerial photos, and ground-truthing (on-the-ground verification) to interpret the geography of a place. Most important, GIS analysis can (1) quantitatively determine the extent of change over time by comparing historic satellite images and aerial photos with present-day images (2) quantitatively pinpoint key areas for land conservation, and (3) present a visually cohesive narrative of spatial trends. Combined, these factors both make the case for land conservation and make it possible to locate crucial properties. However, it is important to recognize that GIS analysis is limited by the quality and sophistication of the data.

Conclusion

Because land use and the overall health of the watershed are intricately linked, scientists believe that population increases and the resulting high percentage of developed land use are the primary cause of environmental problems facing the Barnegat Bay watershed. The rapid transition from agricultural and undeveloped land to primarily suburban land in large sections of the watershed has led to the destruction of wetlands, natural shoreline, the modification of inland areas,[43] and the loss of natural habitat for many native species. Pollution from nitrates and pathogens has degraded the supply and quality of freshwater; the loss of natural spongelike riparian corridors and wetlands has made it harder for the ecosystem to naturally filter pollutants before they enter the water supply. Similarly, the compaction of soils and related increase of impervious land cover has made streams more prone to flooding and reduced the ability of soils to buffer nutrients and pollutants before they enter the groundwater and estuary. Eutrophication may be responsible for the alteration and destruction of vital submerged aquatic vegetation habitat, which could have a profound effect on the overall health of the estuarine ecosystem.

Though these facts would seem to justify pessimism about the future of the Barnegat Bay watershed, there is also reason for hope, based on the conservation successes of the past decades, the growing science of ecological restoration, and the knowledge that there is still valuable land available for conservation. The goals and recommendations of TPL's *Barnegat Bay 2020* plan, detailed in the next section of this report, represent our pledge to work with all concerned individuals and groups determined to save this special place.

[43] *Comprehensive Conservation Management Plan*, 5.

The Greenprinting Process

In October 2007 TPL formed a steering committee of more than 50 individuals to represent the diverse range of stakeholders who live in the watershed or work on issues pertaining to Barnegat Bay. Individuals invited to join the committee were from various constituent groups throughout the region and together reflected the breadth of land conservation, recreation, and other goals incorporated in this report. Between November 2007 and April 2008 the committee met three times.

At the initial meeting, TPL asked the steering committee to describe its objectives. The group developed six principal goals for land conservation in the Barnegat Bay watershed:

1. To protect water quality and supply
2. To improve water quality
3. To protect native habitat
4. To restore habitat
5. To improve recreational access
6. To protect scenic quality

The committee also considered what criteria must exist to achieve these outcomes. For example, to improve recreation opportunities, lands that offer access for boating, for pedestrians, or to the beach should be conserved. Active recreational facilities such as ballfields, playgrounds, and so on may be appropriate in some areas.

Next, TPL formed a subcommittee of local advisors—called the Technical Advisory Team—to assist with development of a Geographic Information Systems (GIS) model design, content, and outcomes. The six-person team had expertise in natural resource protection, water quality and supply, habitat protection, storm water management, cultural assets, parks and recreation, land-use planning, and GIS data.

TPL, with help from the Technical Advisory Team, conducted an analysis at the resource level, meaning that the GIS model looks across the landscape (regardless of property boundaries) for areas having features that met the criteria identified for each goal in this study area. The team members assisted in refining the criteria for each goal identified by the steering committee and locating the data needed to test the criteria.[44] In some cases criteria were further refined owing to the limitations of available data. The technical team ultimately developed one map for each goal. These maps are featured on pages 19 - 21. Areas that best meet the criteria appear in dark red on each goal map.

At the second and third steering committee meetings, participants reviewed maps, made final decisions about clustering of goals, and agreed that four goal maps represent interests in land conservation in this study area. (see pages 14 - 17.)

Barnegat Bay 2020 Goals

Through a consensus process, steering committee participants decided that the land conservation goals for *Barnegat Bay 2020* are the following (in no particular order):

Recreation and Access Priorities —This map (see Map 1, p. 14—Recreation and Access Priorities) indicates which areas provide the best opportunity for improving recreational access in the Barnegat Bay watershed. Areas appearing in dark red and orange are locations that would provide excellent new water access or new sites for parks in urban areas. A variety of criteria were considered, such as the best boating access (as determined by the water's depth, shoreline, roads, aquatic vegetation, sensitive habitat, existing land cover, and existing boat ramps), low-impact pedestrian access, beach access, and new conservation areas located

[44] Visit www.tpl.org/barnegatbay for a list of the criteria, rationale, and data sources used in the GIS model.

close to the bulk of the residential population. As one can see by looking at the map, while there are many opportunities in proximity to the bay, there are also many inland opportunities.

This map identifies more than 70,000 acres of the study area[45] as potential high-priority recreation land. The analysis always identifies high-priority lands regardless of what land is already protected. In this way we were able to profile remaining unprotected priority areas versus those areas that already provide public access. About 45 percent of that land is already protected, which means that 55 percent (about 39,000 acres) still provides high-priority conservation opportunities for this *Barnegat Bay 2020* goal.

Water and Habitat Protection Priorities—This map (see Map 2, p. 15—Water and Habitat Protection Priorities) illustrates in dark red which lands could be conserved in order to protect water quality and special natural habitats in the study area, representing a combination of two of the original six principal goals described above. To protect water quality and supply, the maps suggest targeting lands that contain undisturbed upland permeable soils, headwaters, wetlands, vegetated riparian corridors, recharge areas, marsh migration zones, and lands directly upstream of drinking water intakes. Some of the same criteria are identified for protecting native habitats.

Almost 60 percent, or 174,000 of the 290,000 acres in this category, has not yet been protected. The total land identified as high priority for water and habitat protection is quite a bit more land than appears on the recreation and access opportunity map, but it is important to note that some of the land conserved to benefit water quality or to preserve habitats will also be appropriate for certain types of recreation. In addition, protecting the bay's water quality will help ensure healthy recreational use of the bay for decades to come.

Water and Habitat Restoration Priorities—This map (see Map 3, p. 16—Water and Habitat Restoration Priorities) shows in dark red the areas that ought to be restored in the interests of water quality and supply as well as native habitat sustainability, and also represents a combination of two of the original six principal goals described above. Underpinning this goal is the need to rehabilitate degraded surface water, restore riparian areas, and improve undeveloped shorelines adjacent to bulk headings, nonvegetated riparian zones and transitional uplands, and phragmites areas. Some properties show up as high priority because they are located in a subwatershed that is having water quality problems, and the idea is to protect and properly manage the property to keep it from further degrading the water quality of the nearby stream or river.

Only about 40,000 acres are identified as high priority (about 10 percent of the study area) for this *Barnegat Bay 2020* goal. Very little of this land has already been conserved; in fact, almost 90 percent, or 36,000 acres, is still unprotected.

Scenic Priorities—This map (see Map 4, p. 1—Protect Priorities) identifies in dark red land as high priority for protection if it is adjacent to state-designated scenic roads or habitat areas that are visible from roads and waterways. For example, forested land along the Garden State Parkway appears as high priority. Given the number of roads and waterways that weave through the study area, it is not surprising that much of the study area is a good opportunity for meeting scenic priorities. Roughly 65 percent of the study area (about 280,000 acres) is identified as high priority, and 60 percent, or 168,000 acres of that, is at risk of being developed.

For each of these four goals we also looked at

[45] The study area encompasses 425,117 acres, including the bay, which itself takes up about 68,000 acres. For purposes of calculating percentages in this report, the bay is included as part of the study area.

where these high-priority lands are located on the basis of political boundaries. Please see the Appendix for a list of high-priority land within the top-ten largest towns in the study area for each goal.[46] In sum, Jackson has the most acreage identified for conservation opportunities for all goals except restoration (Manchester township leads in this category). For all goals, Point Pleasant has the least amount of land identified as an opportunity for conservation. These numbers are to be expected since Jackson has the most land area within the watershed and Point Pleasant has the least.

To factor out size, it is useful to compare percentages of land area identified as high priority. Note that only the portion of the municipalities within the study area was analyzed. Almost all (98 percent) of the portion of Howell Township that is in the watershed is identified as high priority for protection, and nearly all of it is currently unprotected; about 30 percent of Toms River scored high for restoration (90 percent of that is currently unprotected); about 30 percent of Brick Township was identified for recreation (about 40 percent of that is already protected); and 80 percent of Lacey is important for scenic quality (but more than 60 percent of that is already protected).[47]

TPL also convened a committee with representatives from groups in the study area that already work on land conservation with willing sellers. This committee assisted in developing a second-tier analysis, moving from the resource to the parcel level and applying additional criteria to further narrow the list of highly desirable parcels. For example, the committee decided to consider only properties without current permanent protection.[48] The committee identified the following criteria to score each remaining high-priority parcel: whether the parcel is threatened by development, whether the parcel is adjacent to already protected land, whether the parcel is a Natural Heritage Site (as determined by the New Jersey Department of Environmental Protection), or whether acquiring the parcel is a goal of a partner.[49] The model scores each parcel based on the responses to those questions.

There are about 900 parcels, (see Map 5, p. 18—Priority Parcel) together encompassing approximately 25,000 acres. Many opportunities are in the headwaters of the study area. Many parcels on this map meet multiple goals—in other words, a parcel may have features that make it desirable for conservation in order to protect water quality and also to provide scenic viewsheds and recreational opportunities. But for simplicity of viewing, on this map every high-priority parcel is color coded to represent only one goal. The actual number of parcels and acreage identified to satisfy each goal is as follows:

Water and Habitat Protection Priorities: 192 parcels, 18,697 acres

Recreation and Access Priorities: 447 parcels, 11,093 acres

Water and Habitat Restoration Priorities: 513 parcels, 4,792 acres

Scenic Priorities: 48 parcels, 1,845 acres

[46] These comparisons were based on 2000 U.S. Census Bureau data, regardless of whether some of the city or town may be outside the study area, which is determined by watershed boundaries as opposed to political boundaries.

[47] This analysis considers only the portion of the municipality's land area within the study area.

[48] In addition, for parcels less than five acres, only vacant properties were considered, and for parcels greater than five acres, only properties that have greater than 75 percent natural cover were considered.

[49] These goals are identified in township open space plans, Pinelands Target Acquisition areas, *Beyond the Century Plan* and TPL's Metedeconk Stewardships Study. They also include Edwin B. Forsythe National Wildlife Refuge's proposed expansion areas, New Jersey Conservation Foundation's "hubs' (undeveloped land with important natural resources) and military installation buffers, as well as lands likely to meet the requirements of federal programs such as the Coastal and Estuarine Land Conservation Program.

The map is included for purposes of discussion and visualization only. With the underlying GIS-based tool, queries will reveal which parcels have the most high-priority land according to the resource-level analysis, who owns the parcel, and will apply the parcel prioritization criteria just described. This will help in the identification of landowners for outreach to assess their interest in conservation. Although the mapping does identify which properties are most valuable for meeting the goals, in some cases the landowners who own those parcels may not be interested in selling, so the list of opportunities will broaden and encompass more of the high priorities identified on the resource-based maps.

Next Steps

As discussed earlier, land use, landowner behavior, and government policies can and do have profound effects on the overall health of the Barnegat Bay watershed. While land acquisition is very important, protected lands can still be degraded if "upstream" or nearby actions are not informed by environmentally sound knowledge. Ideally, the health of the watershed will be something that is promoted vigorously at every level of the many communities that form the Barnegat Bay region. Therefore, the steering committee recommended that between 2008 and 2020 TPL, local governments, and the many partners working in the watershed take the following steps:

1. Increase public awareness

What: Improve knowledge and public awareness about the threats facing Barnegat Bay and the opportunity to use *Barnegat Bay 2020* land conservation goals to help address these threats.

Who: Reach out to elected officials and staff of Ocean and Monmouth counties, elected officials and staff of municipalities, members of local environmental commissions, staff at the New Jersey Department of Environmental Protection, members of the media, educators, schoolchildren, residents, developers, senior groups, garden clubs, and the public at large.

How:

Produce a brochure and a report describing *Barnegat Bay 2020*.

Request that the Asbury Park Press newspaper publish a special supplement pull-out profiling *Barnegat Bay 2020*.

Mail a *Barnegat Bay 2020* postcard with water bills to township residents who receive their water from the bay watershed.

Develop a seminar or training model for local elected officials and environmental commissions (e.g., Mayors' Association, Association of New Jersey Environmental Commissions, Jacques Cousteau National Estuarine Research Reserve).

Design a traveling show and tool kit for the public, and teach volunteers to operate it (it could be offered at the BBNEP Festival, TPL booths, town council meeting presentations).

Announce on partners' web sites.

2. Use the *Barnegat Bay 2020* maps

What: Proactively identify new voluntary land conservation opportunities revealed by the *Barnegat Bay 2020* maps included in this report.

Who: TPL will house the GIS model developed to create these maps, and partners may contact TPL to access information accordingly. Partners, such as the National Estuary Program, are encouraged to post these maps on their program web sites and in local libraries.

How:

TPL and partners should post the maps and begin landowner outreach to determine interest in voluntary land conservation, tracking progress over time and recognizing achievements.

TPL should consider generating a customized map for each municipality in the study area that may be utilized for planning and outreach efforts.

Partners should share these maps with appropriate state and federal lobbyists as an indication of priority lands for conservation.

3. Support new and ongoing funding for land conservation to implement the *Barnegat Bay 2020* goals

What: There are a variety of sources of local, state, and federal dollars for acquiring properties identified on the *Barnegat Bay 2020* (*BB2020*) maps (e.g., the Garden State Preservation Trust, which funds the NJ Natural Lands Trust and NJDEP Green Acres Program, Ocean County Natural Lands Trust Fund, Land and Water Conservation Fund, developer mitigation funds, Conservation Resources, Inc., Coastal Wetlands Conservation grants, Coastal and Estuarine Land Conservation Program, North American Wetlands Conservation Act), but many of these programs require matching funds from local sources. About 40 percent of the municipalities in the study area have passed dedicated open space taxes that serve precisely this purpose.

Who: Local governments without an open space tax should consider passing a measure to be able to access and leverage these new local dollars against state and federal dollars, creating a funding quilt to support conservation in the study area. Those with dedicated open space taxes should consider increasing them. Private dollars may also be leveraged from generous corporate and individual donors.

How:

Contact The Trust for Public Land's Conservation Finance program 617.367.6200 or TPL's local expert Tom Gilbert, 215.343.1110, tom.gilbert@tpl.org, for guidance on raising dedicated open space taxes at the municipal or county level.

Property Portraits

The following descriptions profile five *Century Plan* sites. While their selection does not indicate a ranking or priority list, they are representative of the diversity of the watershed and illustrate the variety of priorities that are supported by the *Barnegat Bay 2020* program.

Havenswood (recreation and restoration priority in *BB2020*): Acquisition of this site would help complete protection of the coastal and upland spaces in the Reedy Creek tidal stream system, which is within the Edwin B. Forsythe National Wildlife Refuge acquisition boundary. The striking number of bird species documented at Havenswood is testimony to the importance of wetlands and adjacent areas for wildlife. Seventy-six varieties of birds were sighted in the area during one half-day period, including five woodland thrush species, which is very unusual. A walk on the deCamp Wildlife Trail to the bay is a treat for the botanist, as numerous hollies, oaks, cherries, and blueberry bushes decorate the path. Also visible: the coastal variant of the fragrant sweet pepperbush; the delicate, elongated bracken fern; and the tiny, baby-blue spring azure butterfly. Conservation efforts at Reedy Creek were initiated by the Ocean County Izaak Walton League, locally known as Save Barnegat Bay, and have been advanced by The Trust for Public Land's Barnegat Bay supporters.

From *The Century Plan*'s commentary on the Havenswood area: "The groundcover, in part, is made up of sheep laurel, blackberry, partridgeberry, low bush blueberry, and teaberry. Tree club moss, which belongs to an ancient lineage of non-flowering vascular plants, forms persistent green patches on the woodland floor. These diminutive plants suggest a well established and undisturbed forest habitat. Club mosses seem to embody or possess a 'wilderness spirit,' as attempts to transplant and cultivate them outside of native woodlands are largely unsuccessful."

Peak of the Forked River Mountains (habitat protection priority in *BB2020*): At 184 feet, this land is one of the highest points in the Pinelands National Reserve. Visitors to the peak can see the Lakehurst naval station hangars in the distance, but mostly it is a tranquil view of a dark green sea formed by the tops of the characteristic pitch pine. The area was once home to small farmers, craftsmen, and woodcutters; now, they are gone and all that is left in this 20,000-plus-acre wilderness are sandy, unpaved roads and the abandoned Tuckerton railroad right-of-way (trails are gnashed from the peak, however, by the ubiquitous all-terrain vehicles, or ATVs, which careen through the hills despite efforts by property owners to keep them off the normally quiet expanse). The dry slopes shelter headwaters of the Forked River

and its marsh creeks, forming high-quality habitat that supports such sport fish as summer flounder. The uplands provide good habitat for wild turkeys, ruffed grouse, and other game birds appreciated by the state's hunters. The ovenbird, with its "teacher, teacher, teacher" call, flits amid the huckleberry bushes.

According to *The Century Plan*, "The high sandy ridges in the vicinity of the 'mounts' provide excellent habitat for the threatened northern pine snake. These are large, robust, black and white serpents that attain lengths of 4.5 to 6.5 feet. During late June or early July, adult gravid female pine snakes migrate to the edges of sand roads, or along the old Tuckerton railroad bed to excavate nest burrows in which they deposit their eggs. This is one of the few North American snakes that actually digs its own nest chamber in soft sand. Year after year the female snakes return to their nesting area, probably the same site from which they emerged as hatchlings."

The nearly pristine landscape of the Forked River wilderness also provides a home for many rare, threatened, and endangered plant and wildlife species, such as Pine Barrens bellwort, Barratt's sedge, livid sedge, pale beaked rush, slender nut rush, Knieskern's beaked rush, curly grass fern, dragon mouth orchid, Pine Barrens gentian, turkey beard, and Pine Barrens reed grass. The carnivorous pitcher plant and the spatulate-leaved and round-leaved sundew abound in the sphagnum bogs. The stunning swamp pink, a federally threatened and state endangered species, can be seen in mid-spring.

Waretown Creek and Park This creek and its black sandy banks, adjacent to the Greenbriar Golf and Country Club in Ocean Township, are lined by a buffer of very spongy soil, high-bush blueberry, and pepperbush. Trident maples make up the canopy. Waretown Lake, formed by damming of

the creek, is a popular site for fishing (pickerel and catfish are among the catches), swimming, picnics, and sunbathing. The township organizes hayrides in the fall around the shore, which also skirts an Atlantic white cedar swamp. A trail leads through the woods to Oyster Creek. Although the township does own properties in the area, there are unprotected lands both upstream and downstream of the lake, and acquisition would protect the lake's water quality.

From *The Century Plan* account: "East of the head of Waretown Lake can be found old cranberry bogs, which were in operation from c. 1936 to 1960. In this area, in the vicinity of the creek bed, flourish natural bog vegetation, plants which specialize in a nutrient-poor, water-laden habitat. The white tufts of cotton grass, the widespread spongy mats of Sphagnum moss, and the bulbous, insect-trapping leaves of the pitcher plant announce that a fragment of a very ancient and unique habitat is being entered. Bog club moss, a relative of the giant trees that made up the bulk of the coal forming forests of the Carboniferous period (over 300 million years ago), is also present as a bog specialist, trailing its green stems over the moist ground. Contiguous with the bog, the wall of Atlantic white cedars marks the location of the creek. While it is important to promote access to recreational areas (Waretown Lake), it is equally important to deflect access where it is not appropriate, as in the vicinity of the bog."

Brick Township Municipal Utilities Authority (MUA) (water and habitat protection priorities upstream in *BB2020*): Acquisition of several upstream sites in the 70-square-mile Metedeconk River watershed could enhance the protection of drinking water that is processed and distributed by the Brick MUA (in summer months, daily demand for water from the utility's 100,000 customers can more than double). In the

last decade, MUA officials say, the water they collect from the Metedeconk has declined in quality, resulting in greater treatment challenges and higher costs. Much of this degradation can be attributed to upstream development in the watershed. The effective use of LID (low impact development) techniques and the strengthening of design standards throughout the Metedeconk watershed are critical, as development and the overall conversion of land to more intensive uses will continue in this area.

Among the upstream sites targeted is the Cabinfield Branch. From *The Century Plan*: "With headwaters in Monmouth County, Cabinfield represents one of the many shorter branches within the Barnegat Bay watershed that runs the gauntlet of development and yet still retains something of its former identity. The Cabinfield Branch flows to the southeast across the Monmouth/Ocean County line through the sizeable town of Lakewood, breaks into more open country north of an extensive Ocean County Park, takes a more southerly course through the Woodlake Golf and Country Club, and, having joined the Schoolhouse Branch, joins the Metedeconk River and channels beneath the Garden State Parkway toward Barnegat Bay. Seemingly far removed from the wide sweep of the cedar-lined pinelands branch or river, Cabinfield reveals itself on a more intimate scale. Its deciduous sun-dappled corridor contains, among other species, red maple, black gum, black cherry, yellow birch, white ash, burning bush, coastal pepperbush, multiflora rose, and green brier. Some of the branch-side red maples are very wide in girth and have reached an estimated age of over 60 to 70 years. The name Cabinfield Branch probably refers to an early cabin of the nineteenth or even eighteenth century—a humble building that once stood in a clearing, bounded by woods and by this secretive branch. Surprisingly, farm fields can still be found adjacent to the branch, near its passage under Brook Road. Here, where a pasture meets the riot of vegetation along Cabinfield, as at many points along the various branches of the watershed, it is possible to slip back in time and to momentarily savor an imagined past."

Pond at Clayton Block An operating sand and gravel processing plant looms over this tranquil pond, fed by the Fourmile Branch. The site is between the Garden State Parkway and Barnegat Bay, an area classified as "near shore" by *The Century Plan*. The majority of these sites, the plan says, retain an "integrity of function ... once they are preserved, an eventual integration of these sites may be possible through the restoration of marsh belts and natural corridors. Coastal and near shore sites harbor outstanding resources for the preservation of biological diversity." The Clayton Block pond (part

of the larger Waterford site of *The Century Plan*) is in the township of Stafford, one of the state's innovators in containing storm water runoff. Numerous drainage strips and fields—only slightly below surface, and grassy, so they can be used as play areas—are visible during a drive through Stafford. "I grew up here and have a real strong passion for the outdoors. I learned to scuba dive nearby and I can remember when the water was crystal clear," said John Spodofora, Stafford councilman and environmental commission chair. The township's regulations require homes to infiltrate runoff on site so that rainfall will not cause erosion and pick up pollutants.[50]

Recommendations for Stewardship

TPL's steering committee made several recommendations regarding good stewardship of properties after they are acquired, including the following:

Develop volunteer organizations that can help with management. Allow local volunteer groups to "adopt an area," with supervision from park or government entities.

During acquisition of properties, seek separate funds to enable good stewardship of acquired land.

Verify that proper forest management is being exercised. Federal grants may be available to pay for this process.

Use the existing management plan at an adjacent property to ensure that proper procedures are being followed at newly acquired parcels.

Be prepared to limit access to a property after determining what is appropriate based on the intended conservation purpose.

[50] There is one exception. Stafford allows runoff to enter adjacent waterways when the municipal ordinance that limits the total allowable impervious lot coverage is exceeded, and the lot is in an area with a seasonal high groundwater that will not allow subsurface recharge. Under those specific conditions, Stafford allows only roof runoff to be discharged into a lagoon or waterway. Roof runoff is classified as clean runoff and must go directly into the lagoon without passing over any land or surface where it can pick up contaminants. This is a special and unique condition and can be allowed only by requesting a variance from Stafford's stormwater management ordinance and total impervious coverage ordinance. Stafford does not allow for any postdevelopment offsite runoff. Allowing this clean roof runoff to go directly into the lagoon will help prevent contaminants from being picked up and entering surface water. It will also help prevent roof runoff from contributing to street flooding. Under all other conditions, all runoff must be discharged on-site using underground recharge.

Looking Forward

The trend in Barnegat Bay land use underlines an increasing need for public open space to act as an environmental "buffer." Without good public access the estuary cannot be enjoyed by all the members of the community. Similarly, if vital natural land is not preserved, a valuable ecological and economic resource will be severely impaired.

It is instructive to recall that in his book *The Pine Barrens* (1968), noted author John McPhee wrote that the Pinelands unique ecosystem seemed to be "headed slowly toward extinction," chiefly because of the unlikelihood of collaboration among "the big and little powers that would have to work together to accomplish *anything* on a major scale in the pines" (McPhee's italics).[51] Yet ten years later, the U.S. Congress and the state of New Jersey acted jointly to give the Pinelands national reserve status.

A good start has also been made in the Barnegat Bay watershed using land conservation and other tools, and this report reflects the collaboration of many of these same "big and little powers." This approach can serve to help prevent further degradation by strategically protecting vital habitats and water supply, and in some instances, restoring land as natural functioning systems. Furthermore, many local governments are open to land conservation initiatives to meet the recreational needs of residents and tourists and fulfill planning mandates by federal, state, and local environmental agencies.

The Trust for Public Land is pleased to be working with organizations and local governments who know and love the Barnegat Bay watershed, as well as with committed citizens who value this resource. Together, we are certain to achieve greater success in protecting this place for the enjoyment of future generations.

[51] John McPhee, *The Pine Barrens* (New York: Farrar, Straus & Giroux, 1968), 156.

Acknowledgments

Barnegat Bay 2020

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APPENDIX: Barnegat Bay 2020 Resource Priorities by Largest Municipalities

		Protection Priorities				Restoration Priorities				Recreation Priorities				Scenic Quality Priorities			
	Total Acres Within BB area	Priority Acres	Priority % of BB area	Unprotected priority acres	Unprotected % of resource	Priority Acres	Priority % of BB area	Unprotected priority acres	Unprotected % of resource	Priority Acres	Priority % of BB area	Unprotected priority acres	Unprotected % of resource	Priority Acres	Priority % of BB area	Unprotected priority acres	Unprotected % of resource
Barnegat Bay Study Area	425,117	290,900	68%	166,423	57%	39,709	9%	34,593	87%	72,673	17%	39,100	54%	279,327	66%	166,378	60%
Berkeley Township	27,590	20,771	75%	9,170	44%	2,219	8%	1,029	46%	8,043	29%	3,205	40%	17,178	62%	6,905	40%
Brick Township	14,270	8,905	62%	7,114	80%	439	3%	374	85%	4,426	31%	2,942	66%	5,366	38%	3,716	69%
Howell Township	13,125	12,888	98%	12,793	99%	644	5%	644	100%	2,599	20%	2,598	100%	6,091	46%	6,001	99%
Jackson Township	60,718	53,202	88%	33,421	63%	8,789	14%	7,599	86%	10,320	17%	6,902	67%	41,636	69%	23,927	57%
Lacey Township	49,575	44,375	90%	17,093	39%	1,361	3%	897	66%	7,392	15%	3,280	44%	40,401	81%	15,047	37%
Lakewood Township	16,030	13,510	84%	12,257	91%	665	4%	658	99%	3,457	22%	2,547	74%	6,910	43%	5,907	85%
Manchester Township	31,880	24,077	6%	16,939	70%	9,274	29%	9,070	98%	5,025	16%	3,855	77%	21,816	68%	15,099	69%
Point Pleasant Borough	1,921	245	13%	214	87%	16	1%	15	99%	194	10%	174	90%	203	11%	183	90%
Stafford Township	27,663	22,851	83%	6,809	30%	532	2%	436	82%	6,150	22%	1,909	31%	19,851	72%	5,910	30%
Toms River Township	26,666	11,870	45%	9,783	82%	7,658	29%	6,844	89%	5,843	22%	4,071	70%	9,308	35%	7,351	79%