



2026

STATE OF THE BAY



TABLE OF CONTENTS

Glossary of Terms	2
Director's Comments	3
INTRODUCTION TO THE BAY	5
Director's Comments	4
How to use this report	7
WATER QUALITY	
Public Beach Closures	9
Approved Shellfish Harvest Areas	11
HABITATS	
Submerged Aquatic Vegetation	13
Wetlands and Riparian Buffer	17
Wetland Protection	19
Clam Restoration	19
WATER SUPPLY	
Ecological Flows	23
Water Conservation & Reuse	25
ENVIRONMENTAL CONDITIONS	
Air Temperatures	29
Precipitation	29
Nitrogen	30
Total Maximum Daily Loads	31
A NOTE FROM BBP'S FORMER DIRECTOR	35
ACKNOWLEDGEMENTS	38

NOTEABLE ABBREVIATIONS

CORE DOCUMENT ABBREVIATIONS

SOTB	State of the Bay
BBP	Barnegat Bay Partnership
CCMP	Comprehensive Conservation Management Plan

HABITAT AND ENVIRONMENTAL CONDITIONS

SAV	Submerged Aquatic Vegetation
TMDL	Total Maximum Daily Load
DO	Dissolved Oxygen
NPS	Non-point Source Pollution

GEOGRAPHIC, REGIONAL, AND AGENCY TERMS

BB-LEH	Barnegat Bay-Little Egg Harbor Estuary System
NJDEP	NJ Department of Environmental Protection

GLOSSARY OF IMPORTANT TERMS

WATERSHED & ESTUARY DYNAMICS

ESTUARY

A partially enclosed coastal body of water where freshwater from rivers and streams mixes with salty ocean water. Barnegat Bay is a shallow, lagoonal estuary.

WATERSHED

The entire area of land that drains all of its rainfall and streams into a common outlet—in this case, the Barnegat Bay estuarine system.

SUBMERGED AQUATIC VEGETATION (SAV)

Rooted, underwater plants (such as eelgrass) that grow in shallow estuarine waters. They produce oxygen, stabilize the bay floor, and provide critical nursery habitat for fish and crabs.

RIPARIAN BUFFER

A vegetated area (often containing trees, shrubs, or grass) near a stream or river bank. These buffers act as natural filters, trapping pollutants before they can wash into the water.

SWALE

A shallow, vegetated ditch or depression designed to slow down and infiltrate stormwater runoff into the ground rather than letting it flood straight into local streams.

WATER QUALITY AND POLLUTION

NONPOINT SOURCE POLLUTION

Pollution that does not come from a single, distinct source (like a pipe), but is instead picked up by rainfall and snowmelt moving over the ground. Examples include pet waste, lawn fertilizers, and motor oil.

INDICATOR BACTERIA

Microorganisms monitored by health officials to evaluate water safety. While often harmless themselves, their presence indicates contamination from animal or human waste may be present.

TOTAL MAXIMUM DAILY LOAD (TMDL)

The maximum amount of a specific pollutant (such as nitrogen) that a body of water can receive while still meeting water quality standards.

FECAL COLIFORM BACTERIA

A specific group of bacteria passed through the fecal excrement of humans and warm-blooded animals. It is heavily monitored by the NJDEP to safely classify shellfish harvesting zones.

SHELLFISH HARVEST CLASSIFICATIONS

APPROVED

Shellfish may be harvested.

CONDITIONALLY APPROVED/SEASONAL

Shellfish may be harvested during certain seasons.

RESTRICTED

No shellfish harvest unless issued by a special permit.

PROHIBITED

No shellfish harvesting.

SUSPENDED

Area pending classification, no harvest.

POLICY & MANAGEMENT

CCMP

Comprehensive Conservation Management Plan: The core long-term roadmap created by the National Estuary Program to restore and protect the ecological health, water quality, and living resources of the bay.

ECOSYSTEM-BASED MANAGEMENT

An environmental management approach that looks at the whole ecosystem—including human interactions, wildlife, water supply, and habitats—holistically, rather than managing a single species or problem in isolation.

MINIMUM ECOLOGICAL FLOWS

The minimum amount of water flow required in a stream or river to maintain a healthy aquatic habitat and prevent ecological collapse.



INTRODUCTION TO THE BAY

The 75-square-mile (194 km²) Barnegat Bay **estuary** comprises three shallow, micro-tidal bays: Barnegat Bay, Manahawkin Bay, and Little Egg Harbor. This coastal environment stretches over 42 miles in length from the Point Pleasant Canal on the northern end to Little Egg Harbor Inlet on the southern end, and is separated from the ocean by a nearly continuous barrier island complex of beaches, dunes, and wetlands.

The Barnegat Bay **watershed** encompasses more than 600 square miles of land draining into the 11 rivers and streams that empty into the Barnegat Bay-Manahawkin-Little Egg Harbor estuary. A significant source of freshwater for this aquatic network comes from tributaries within the New Jersey Pinelands and surrounding woodlands. From the headwaters of these streams, pristine freshwater flows eastward through predominantly forested areas along the coastal plain into the bay.

A nearly continuous barrier island complex runs along the eastern edge of the bay. Seawater enters the estuary through the Point Pleasant Canal via the Manasquan Inlet in the north, the Barnegat Inlet in the center, and the Little Egg Inlet to the south. This marine inflow mixes with freshwater from rivers, creeks, and groundwater, producing the diverse salinity zones critical for local wildlife and human activities alike. Geographically, the surrounding watershed encompasses most of Ocean County's 33 municipalities, alongside four in Monmouth County and one in Burlington County. Consequently, environmental activities impacting the Manasquan River to the north and Great Bay to the south closely affect the entire basin.

THE BARNEGAT BAY PARTNERSHIP - A NATIONAL ESTUARY PROGRAM

In response to growing concerns over the health of Barnegat Bay and in recognition of its immense economic value, the New Jersey Legislature mandated a study in 1987 to analyze the impacts of regional development on the bay and its watershed. The findings prompted New Jersey Governor Christine Todd Whitman to submit an application to the U.S. Environmental Protection Agency (USEPA) in March 1995. This application successfully nominated Barnegat Bay to be recognized as an estuary of national importance and integrated into the National Estuary Program (NEP).

Congress established the NEP in 1987 under Section 320 of the Clean Water Act (33 U.S.C. §1330) to identify, restore, and protect nationally significant estuaries across the United States. In July 1995, the USEPA accepted the state's nomination, officially designating the Barnegat Bay Estuary as one of only 28 estuaries of national significance.

In April 1996, the USEPA and the New Jersey Department of Environmental Protection (NJDEP) entered into a joint agreement, officially convening the Barnegat Bay National Estuary Program Management Conference. The primary directive of this collaborative group was to design a Comprehensive Conservation and Management Plan (CCMP) to rehabilitate and protect the bay. Approved by the USEPA in May 2002, the initial CCMP guided the organization's conservation initiatives for nearly a decade.

Beyond establishing this management framework, Section 320 of the Clean Water Act chartered the Barnegat Bay Partnership (BBP). This coalition unites federal, state, county, municipal, academic, business, nonprofit, and private entities to protect the estuary. Over the years, the BBP has continuously monitored its progress toward the goals, objectives, and actions set forth in the 2002 plan, updating its priorities through consecutive Strategic Plans spanning 2008–2012 and 2012–2016. Between 2016 and 2020, the partnership undertook a thorough revision of its foundational framework. This effort culminated in a 2021 CCMP update that incorporates vital advancements in our ecological understanding and outlines modern strategies to safeguard water quality, water supply, habitats, and biotic resources.

As a statutory requirement for all NEPs under the Clean Water Act, the BBP produces a “State of the Bay Report” every five years. This publication details the status and trends of key indicators—such as water quality, natural resources, and public use—to help inform future CCMP updates. Previous iterations were completed in 2005, 2011, 2016, and 2021.

ECOSYSTEM-BASED MANAGEMENT

Rather than addressing issues or species in isolation, the 2021 CCMP adopts an ecosystem-based management approach. This framework protects and manages natural resources by evaluating the interconnected components of the environment and their dynamic interactions. Through this methodology, resource managers, researchers, policymakers, elected officials, and residents collaborate to diagnose and resolve complex environmental challenges. By examining the multiple compounding causes or modifiers of a given problem, decision-makers can better evaluate how natural processes and human activities collectively impact the environment, ultimately yielding more holistic solutions.

ECOSYSTEM TARGETS

Ideally, ecosystem-based targets are broad, with each individually integrating environmental improvements across four key priority areas: Water Quality, Water Supply, Living Resources, and Land Use. Developed by specialized expert panels, the Barnegat Bay targets focus on metrics rooted in established monitoring programs and existing datasets. These panels analyzed historical data for each target to provide guidance on realistic "stretch" goals based on prior watershed achievements. Ultimately, the eight final targets aim not only to protect against future environmental degradation, but also to drive the measurable restoration of these natural resources. Over the next 20 years, the BBP will collaborate alongside its partners to fulfill these vital ecological milestones.



DIRECTOR'S COMMENTS

This report presents the status of the Barnegat Bay Partnership's eight ecosystem-based targets which represent holistic metrics of the Bay's health. These targets were established by the Partnership during the creation of the 2021 Comprehensive Conservation and Management Plan, and provided the foundation for the 2021 State of the Bay Report. The eight integrated targets were established not only to guard against future loss/degradation but also to work towards restoration and measurable improvements. Broadly, the targets address the **water quality** of the bay (public swimming beaches, shellfish harvest areas), **habitats** of the bay (submerged aquatic vegetation extent, wetland acreage, riparian buffers, and hard clam populations), and **water supplies** to the bay (water conservation, ecological flows). Thus, achieving these targets would result in a healthy and resilient Bay and watershed.

At this time, the status of many targets is unknown. Most require bay-wide mapping or assessments which are both time consuming and costly. Thus, the statuses of targets are updated infrequently. Since the initial creation of targets five years ago, the Partnership committed to and successfully obtained almost \$900,000 to update submerged aquatic vegetation extent, riparian buffer and wetland mapping, and establish ecological flow thresholds. This work is expected to be completed within the next several years. While many "Unknown" statuses are given in this report, tremendous progress has been made since the targets were established in 2021. For each target in the report, we have provided an update on the progress to date and also identified needed investments.

NOT ACHIEVING

Several Public Swimming Beaches exceeded their safe swimming standards more frequently than during their baseline time period (2016-2018).

While most beaches are routinely safe for swimming, several problematic areas such as Beachwood, Hancock, Windward, and several lake beaches need track-down studies and restoration to pinpoint and address sources of bacteria.

Acres of Approved Shellfish Waters decreased from the last report. While this decrease was small, it represents a loss of previously approved waters. Similar to public beaches, track-down studies and restoration work are needed to pinpoint and address sources of bacteria.

TARGETS ACHIEVED

No targets can be considered "Achieved" at this time.

IN PROGRESS

New maps quantifying Submerged Aquatic Vegetation extent were developed, but poor image clarity resulted in a high degree of uncertainty in the total acreage. NJDEP and Rutgers are working to resolve the uncertainty of these maps, and improve the total acreage estimate. Funding has also been obtained for further research and restoration activities. Several groups are developing potential restoration actions.

The USGS has completed the first phase of its study to identify minimum ecological flows in select Barnegat Bay tributaries. USGS scientists compared streamflow statistics between historical and current time periods to better understand trends in watershed flow conditions. This work provides a foundation for developing ecological flow targets in the Barnegat Bay watershed. Similar to SAV extent, funding (approximately \$450K) has been obtained by the BBP to complete the remaining phases necessary for threshold determination.



UNKNOWN

There is limited data available to quantify Wetland and Riparian Buffer Preservation, or updated data to quantify Wetland Acreage. The BBP has obtained funding and will begin assessment efforts for both targets, in the next few years.

Hard Clam abundance has not been updated since 2012. Recovery of the stock will be guided by the Fishery Management Plan for Hard Clams, which is under development with the NJDEP, BBP, and other organizations. Reclam the Bay and other partners have continued to plant clams for restoration purposes. Continued plantings in strategic locations which maximize survival and reproduction is one strategy to pursue in the coming years. This work can use a model developed by Rutgers with BBP funding which identified areas where planted clams could have the greatest dispersal of their larvae and thus potentially maximally contribute to the recovery of the stock.

Water Withdrawals were over the target in the 2021 report; USGS has not yet completed its latest update, so a definitive determination of status is not available. However, additional NJDEP data show that it is likely that we continue to not meet the target. Per capita water use has gone down, demonstrating the effectiveness of water-saving appliances and practices, but that decrease has been offset by population gains.

LOOKING AHEAD

At its core, the Partnership is a water quality organization. Healthy nutrient concentrations are fundamental to the mission of the Partnership. While there is no specific adopted nutrient reduction target just yet the soon to be proposed Total Maximum Daily Load (TMDL) of Nitrogen represents a culmination of over 15 years of work by the NJDEP, USGS, and other partners to establish a nutrient load and water quality criterion. Unfortunately, many water quality stations do not meet the new standard, especially those in the northern Bay, where more work needs to be done. However, strengthened stormwater regulations and fertilizer laws may already be starting to have an effect: Total Nitrogen concentrations have not increased at any station in the Bay over the last ten or more years. Studies in other systems suggest changes in land practices may take a decade or more to manifest in the Bay's waters; thus, no stations getting worse over the past ten years is an optimistic sign of progress. With the implementation of the TMDL, we'll hopefully see more progress in the future. Just remember, the bay is everyone's responsibility!

Andrew McGowan



HOW TO USE THIS REPORT

A status gauge is shown for each of the eight Ecosystem Targets. Determination of whether the target is being met is based on data available from 2021 through 2025.



The status gauge is divided into four parts: Unknown, In Progress, Not Achieving, and Achieving. The needle points to the appropriate status for the indicator. A status of Unknown indicates that the current status is uncertain, either due to a lack of data or data that has not been updated recently.

“In Progress” status is given to indicators for which a significant amount of progress has been made during the reporting period toward achieving an unknown target or toward quantifying the status of the target. Not Achieving indicates that the target is not being met, while an Achieving status indicates that the target is currently being fully satisfied.

A list of what progress has been made and what investments are still needed has been provided for each target.

WHAT’S INSIDE, AT A GLANCE

WATER QUALITY

Public Beach Openings/Closures

Number of beaches with higher exceedance rates than their baseline

Not Achieving

Shellfish Harvest Areas

Acreage of waters approved for shellfish harvest between 2020 and 2025

Not Achieving

HABITAT

Submerged Aquatic Vegetation

SAV acreage

Biomass of *Zostera* and *Ruppia*

In Progress

No Trend

Reduced

Wetlands and Riparian Buffer Preservation

Unknown

Wetland Protection

Unknown

Clam Restoration

Unknown

WATER SUPPLY

Ecological Flows

In Progress

Water Conservation & Reuse

Unknown





PUBLIC BEACH CLOSURES

CCMP Priorities: Water Quality

TARGET

No beaches will exceed the safe swimming standard more frequently than their baseline exceedance percentage from 2016-2018.



PROGRESS MADE

- Many beaches are consistently safe for swimming.

INVESTMENT NEEDS

- Beachwood, Hancock, Windward, and several lake beaches need additional track-down studies to pinpoint sources of bacteria.
- Unofficial but utilized beaches, such as in the Toms River, also need track-down studies to pinpoint sources of bacteria.

BACKGROUND

While most bacteria in the bay are harmless, certain species can cause illness or infection. These microorganisms enter the water from sources like animal and human waste, transported by stormwater runoff or leaking septic and sewer systems. To ensure safe swimming conditions, the Ocean County Health Department monitors two specific indicator bacteria: *E. coli* in freshwater and *Enterococcus* in saltwater or brackish areas. *E. coli*, a type of fecal coliform, can directly cause illness upon exposure. Conversely, *Enterococcus* is typically benign, but its presence signals that other harmful pathogens may be lurking in the water. Ultimately, how often a beach exceeds safe swimming standards reflects the frequency and volume of bacteria being flushed from the watershed into the waterways feeding the bay.

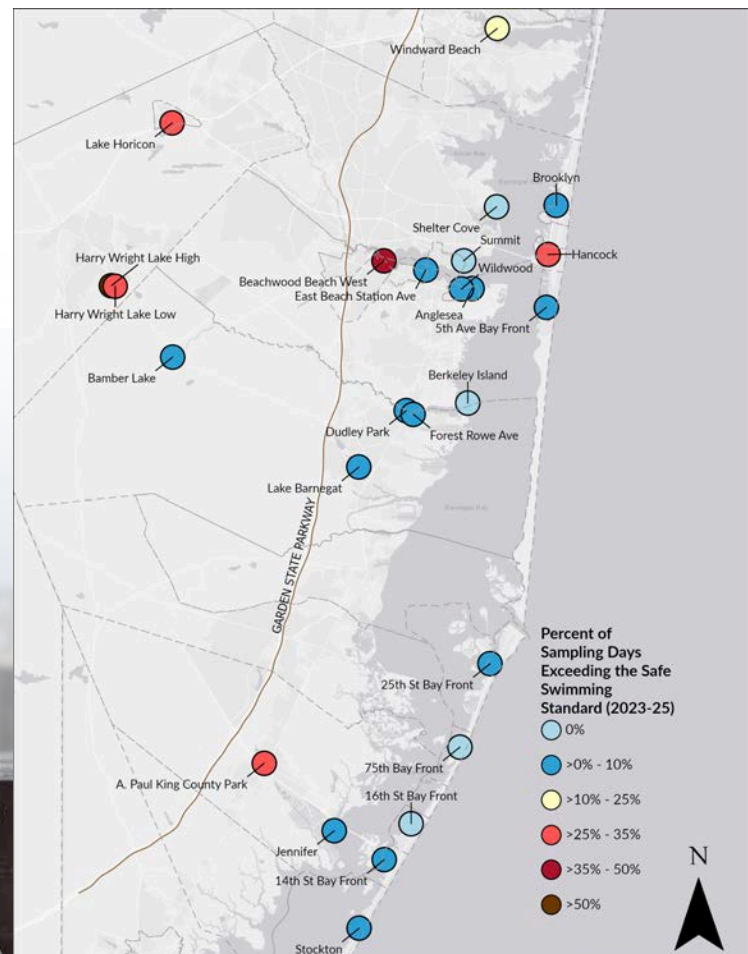


Figure 1: Percent of sampling days exceeding the safe swimming standard from 2023-2025.



PRIMARY INDICATOR: BEACH OPENINGS/CLOSURES

STATUS

The percentage of sampling days that each beach exceeded safe swimming standards during the summer months between 2016 and 2018 established the baseline. This seasonal window was selected because the vast majority of recreational swimming occurs during this period. From 2023 through 2025, five of the 25 monitored locations (20%) exhibited higher exceedance rates than their baseline, indicating that water quality at those sites deteriorated over time; consequently, the ambitious target of zero declining beaches was not achieved. On a positive note, many monitored areas continue to maintain very low exceedance frequencies and remain routinely safe for swimming (Figure 1). However, a few problematic locations—such as Beachwood and Hancock—persistently lag behind and should be prioritized by their respective municipalities for targeted investigation and remediation.

To pinpoint and address bacterial contamination, municipalities and researchers can conduct pathogen trackdown studies. These investigations determine whether the pollution stems from human or animal origins, uncovering specific infrastructure failures like sewer line breaks or neglected maintenance. Once these problems are identified, targeted repairs and public education initiatives effectively lower bacteria levels. On an individual level, one of the most impactful ways residents can help protect local water quality is by properly disposing of pet waste, preventing stormwater runoff from carrying harmful bacteria directly into storm drains and local waterways.

TREND

The number of beaches performing at or above their 2016–2018 baseline has remained relatively flat over time, indicating no statistically significant trend in the data (Figure 2). Currently, 20 beaches meet or exceed that baseline. For comparison, the 2017–2019 period immediately following the baseline window tracked 21 compliant beaches. This marginal difference underscores how little overall change has occurred across the monitored locations.

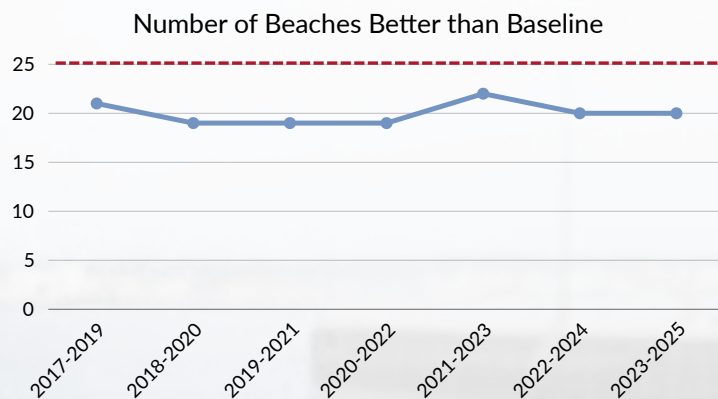


Figure 2: Beaches meeting or exceeding 2016–2018 baselines (n=25). The dashed red line indicates the target.

WHAT YOU CAN DO



Call 1-877-WARNDEP to report water pollutants



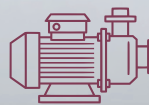
Support source tracking studies at the municipal level



Dispose of pet waste properly



Do not feed wildlife



Pump and regularly (3 year) inspect septic system

APPROVED SHELLFISH HARVEST AREAS

CCMP Priorities: Water Quality, Living Resources



TARGET

Upgrade 5% of the potentially harvestable shellfish acreage that is currently restricted or closed for shellfishing compared to the 2020 acreage (11,267 acres).

PROGRESS MADE

- Most shellfish beds remain open for shellfish harvest.

INVESTMENT NEEDS

- Studies are needed to locate and address sources of bacteria.

BACKGROUND

As filter feeders, bivalves like clams and oysters ingest waterborne pollutants, including bacteria, from their surroundings. Common vectors for these unwanted bacteria include wildlife, domestic animal waste, and human sewage leaking from compromised septic or sewer systems. Because shellfish are frequently consumed raw, they carry a higher risk of causing foodborne illness than other seafood.

To protect public health, the NJDEP's Bureau of Marine Water Monitoring tracks fecal coliform levels—an indicator of fecal contamination—throughout the bay.



Based on these monitoring results and proximity to potential pollution vectors, harvesting waters are classified into five categories: approved, conditionally approved, restricted, prohibited, or suspended. State officials review these designations annually, analyzing the 30 most recent data points collected at each monitoring station over a multi-year period.

PRIMARY INDICATOR: APPROVED SHELLFISH HARVEST AREAS

STATUS

Currently, approximately 72.3% (50,545 acres) of Barnegat Bay waters are approved for shellfish harvesting. The remaining areas are classified as restricted (10.4%; 7,397 acres), conditionally approved (8.0%; 5,630 acres), prohibited (5.4%; 3,821 acres), and suspended (4.0%; 2,758 acres), as shown in Figures 3 and 4. These figures reflect a 1.3% decrease in approved acreage since 2020, driven primarily by a 1.9% expansion of suspended zones. While this downward shift is minor, it indicates that the target of expanding approved shellfish waters has not yet been achieved.

TREND

Poor water quality near shellfish beds is typically linked to stormwater runoff and other nonpoint sources rather than single, identifiable discharges. This pattern is most evident in the northern portion of the bay, where the majority of prohibited and restricted waters occur. The red prohibited zones shown offshore in Figure 3 represent administrative buffers around wastewater outfalls or other potential bacterial vectors, rather than actual, measured degradation.



IMPORTANT TERMS:

APPROVED

Shellfish may be harvested.

CONDITIONALLY APPROVED

Shellfish may be harvested during certain seasons.

RESTRICTED

No shellfish harvest unless issued by a special permit.

PROHIBITED

No shellfish harvesting.

SUSPENDED

Area pending new classification; no harvest.

Over the past 14 years, the total acreage classified as restricted or prohibited has remained largely unchanged. However, approved harvesting waters have decreased slightly—marking a loss of 1,708 acres since 2011—while suspended classifications have expanded by 2,758 acres over that same timeframe (see Figure 4).

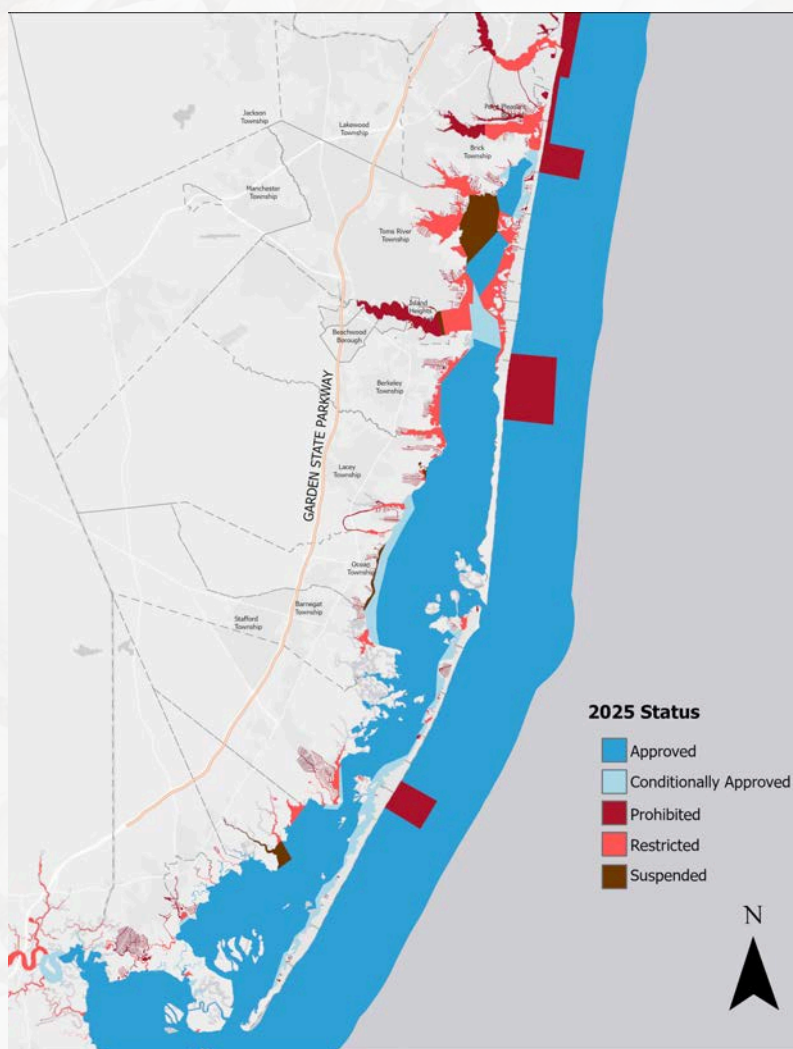


Figure 3. 2025 Shellfish harvest waters classifications for the Barnegat Bay.

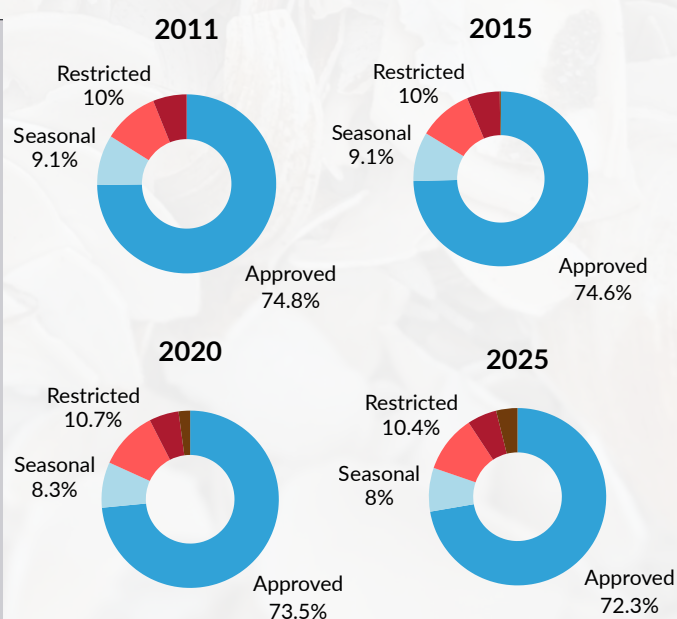


Figure 4: Percent of waters with approved, seasonal, restricted, prohibited, and suspended status per year.

WHAT YOU CAN DO



Sweep streets and properly dispose materials



Dispose of pet waste properly



Call 1-877-WARNDEP to report broken sanitary sewer lines



Use Ocean County pump-out boats, don't discharge bilge into the bay

SUBMERGED AQUATIC VEGETATION

CCMP Priorities: Water Quality, Living Resources, Water Supply, Land Use

TARGET

Maintain the overall extent of submerged aquatic vegetation (SAV) present in 2009 (12,980 acres) and restore an additional 10 acres of seagrass.

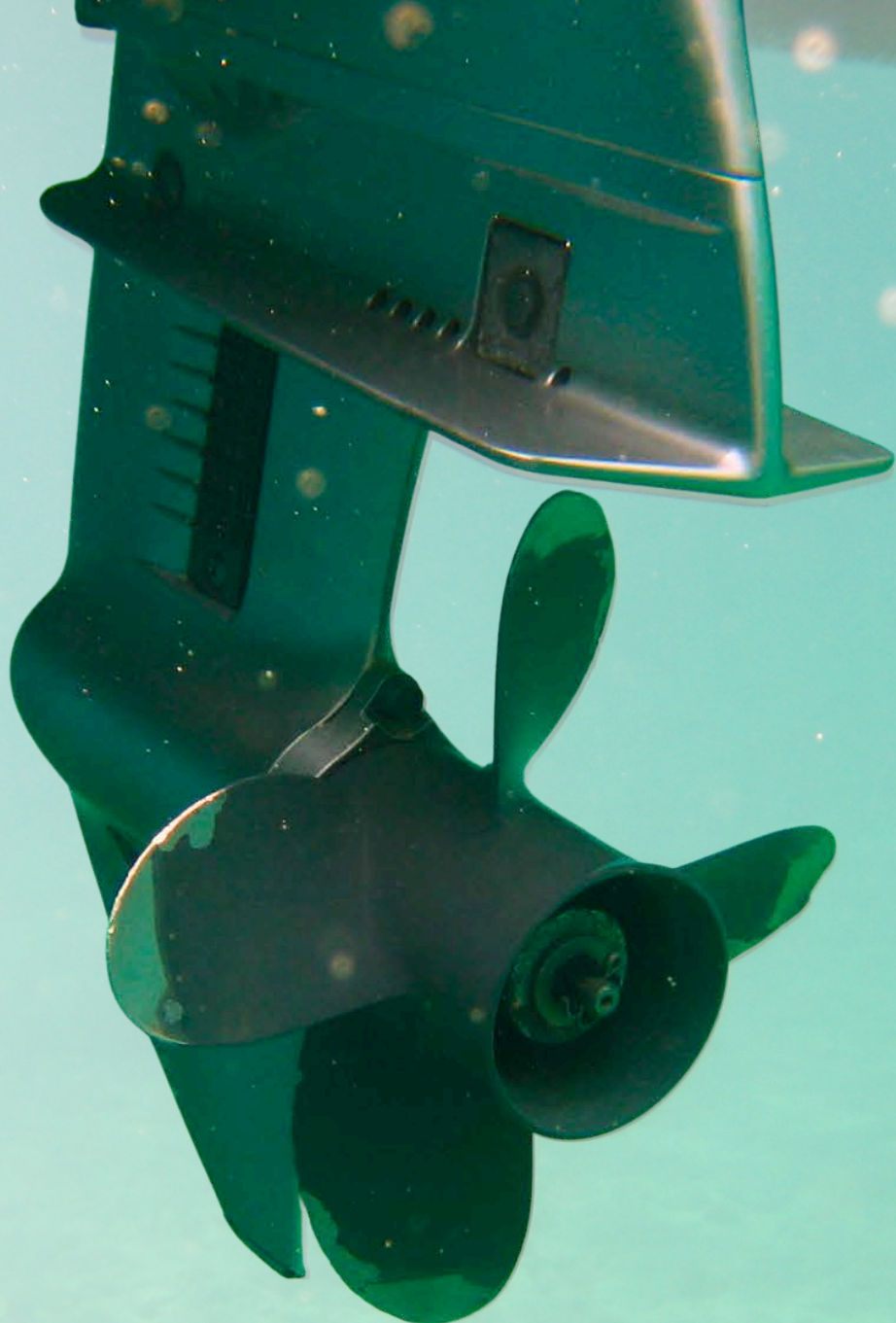


PROGRESS MADE

- New SAV maps have been created and are being refined.
- Funding has been committed to priority research and restoration efforts.

INVESTMENT NEEDS

- Regular Bay-wide mapping informs long-term SAV management.
- Infrastructure (e.g., seed processing facilities) is vital to SAV restoration.
- Reductions in nutrient and sediment loading is needed to protect existing beds.



BACKGROUND

Seagrass beds provide essential habitat for many key estuarine species, including bay scallops, blue crabs, and summer flounder. These underwater meadows improve water quality by trapping pollutants, stabilizing benthic sediments, and dampening wave energy. Because these plants require exceptional water clarity and react sharply to excess nutrients, they serve as invaluable indicators of the bay's overall ecological condition.

Monitoring these habitats over time allows scientists to track shifting water quality trends. Beyond nutrient loading, these sensitive ecosystems face physical threats from boat propellers, clam rakes, and severe storms that can uproot them or bury them in sediment. Within Barnegat Bay, eelgrass (*Zostera marina*) dominates the southern waters below Toms River, whereas mixed beds of eelgrass and widgeon grass (*Ruppia maritima*) are more prevalent throughout the northern and central segments.

PRIMARY INDICATOR: EXTENT OF SUBMERGED AQUATIC VEGETATION STATUS

Funded by the NJDEP and BBP, a bay-wide seagrass survey was completed in 2023 through a collaboration between Rutgers University and Stockton University (Figures 7-8). These assessments typically rely on spring aerial photography when biomass is at its peak. However, unprecedented wildfire smoke and inclement weather delayed the 2023 data collection until autumn, a period when these underwater beds naturally decline. Additional weather complications during the fall flights introduced greater uncertainty in identifying the meadows. Consequently, while new acreage estimates were successfully produced, direct comparisons to historical datasets are currently inappropriate.

A total of 10,991 acres of seagrass were mapped during this cycle, representing a decrease of roughly 2,000 acres compared to 2009. However, an additional 5,000 acres were classified as uncertain or potential habitat. Because the flights took place in the fall when seasonal coverage is lower, the 10,991 acres of mapped meadows likely represent a highly conservative estimate.

TREND

Due to methodological differences between the 2009 and 2023 surveys, combined with a lack of intermediary data, a definitive trend cannot be determined.

KNOWLEDGE GAPS

A recurring spring assessment utilizing clear, high-quality imagery of submerged aquatic vegetation (SAV) is essential to determine if the bay is on track to maintain its seagrass targets. While the preliminary conservative estimate suggests an 18% decrease in acreage over the past 14 years, the extensive size of the unverified zones means that as mapping is refined, final totals may actually exceed the target.

To resolve this uncertainty, the NJDEP and Rutgers University are collaborating to deliver a more precise assessment in the near future. Significant funding has been directed toward mapping and researching these vital habitats, with active restoration initiatives and supporting studies scheduled to begin soon.

While tracking total acreage is critical, evaluating the qualitative condition of the meadows offers deeper insight into overall ecosystem health. Consequently, a secondary indicator, aboveground biomass, is utilized to evaluate the vitality of these beds, where higher biomass indicates more robust growth and superior habitat health.

SECONDARY INDICATOR: SUBMERGED AQUATIC VEGETATION DEMOGRAPHICS STATUS

Bay-wide surveys of seagrass bed biomass revealed a reduction in both *Zostera* and *Ruppia* spring time aboveground biomass during this period (2023 and 2025), compared to the surveys from the previous five-year period. Biomass in 2025 was much lower than what was measured in 2021 or 2023 for both species in all three Bay segments (Figures 5-6). The decrease in *Zostera* in the central and southern portions of the Bay was particularly pronounced.

In 2023 aboveground biomass was 128 g/m² in the central Bay while in 2025 the biomass was 43 g/m². In 2023 the biomass was 90 g/m² in the southern Bay, while in 2025 the biomass was 30 g/m². The cause of these declines is unknown, underscoring the need for establishing a more comprehensive monitoring and research program to study how factors like temperature, light, nutrients, turbidity, and chlorophyll affect seagrass growth in the bay. While additional steps to reduce nutrient loading are clearly important for SAV recovery, additional information potentially directs additional steps needed to address the decline.

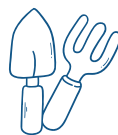
WHAT YOU CAN DO



Do not boat or anchor within seagrass beds.



Minimize fertilizer use, especially in fall & spring.



Plant a rain garden and increase buffer between your home and storm drains.



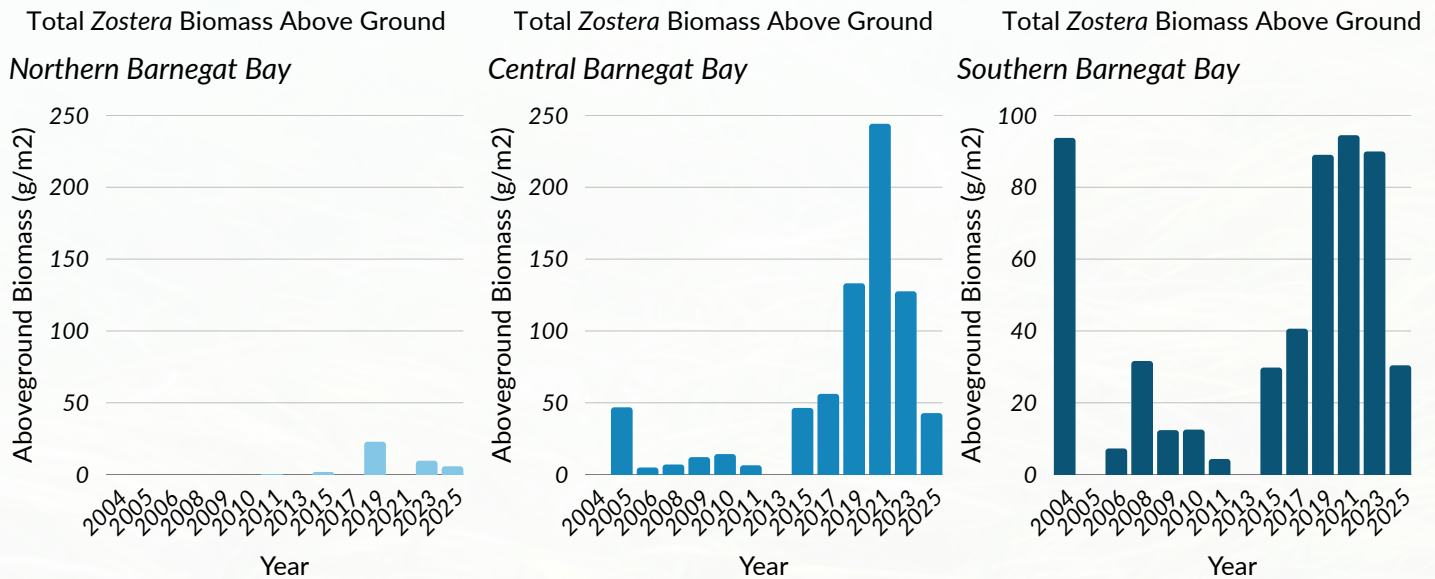


Figure 5: Annual spring mean above ground biomass of eelgrass (*Zostera marina*) in the Barnegat Bay-Little Egg Harbor estuary between 2004 and 2025.



When reading these figures, note the difference in the scale of the aboveground biomass for each type of vegetation.

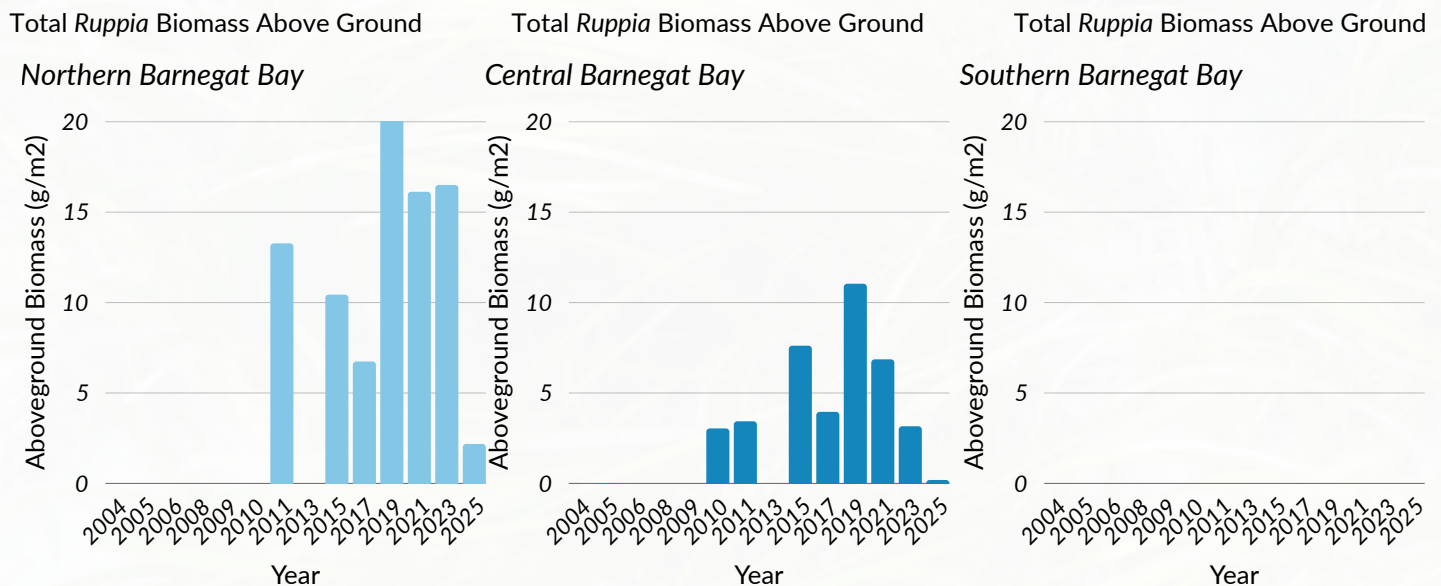


Figure 6: Annual spring mean above ground biomass of widgeon grass (*Ruppia maritima*) in the Barnegat Bay-Little Egg Harbor estuary between 2004 and 2025. No widgeon grass was recorded in the southern part of the estuary.

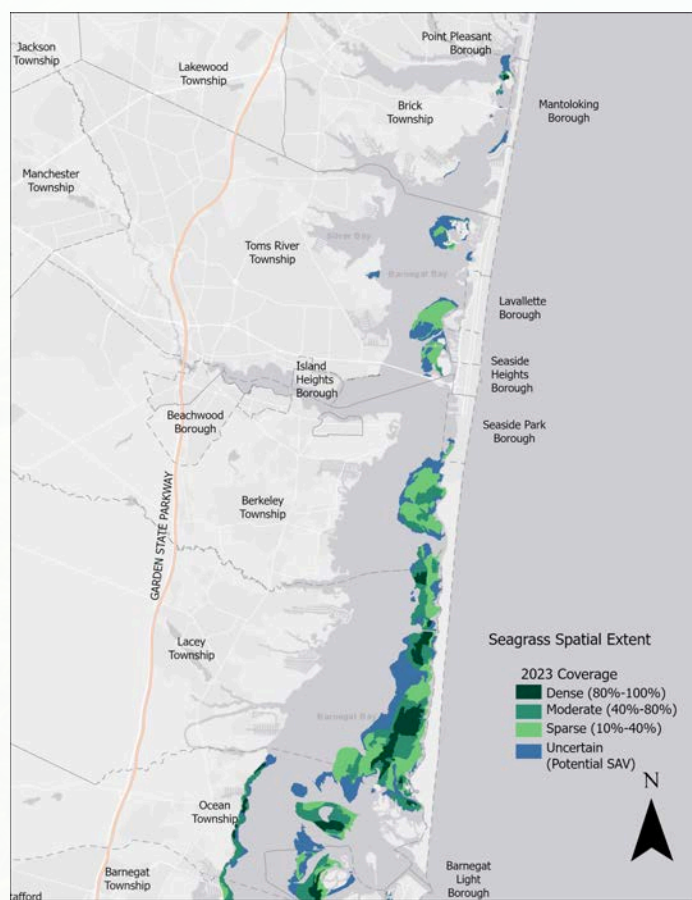


Figure 7. Extent of seagrass meadows (including eelgrass and widgeongrass) from Barnegat Inlet north to Point Pleasant.

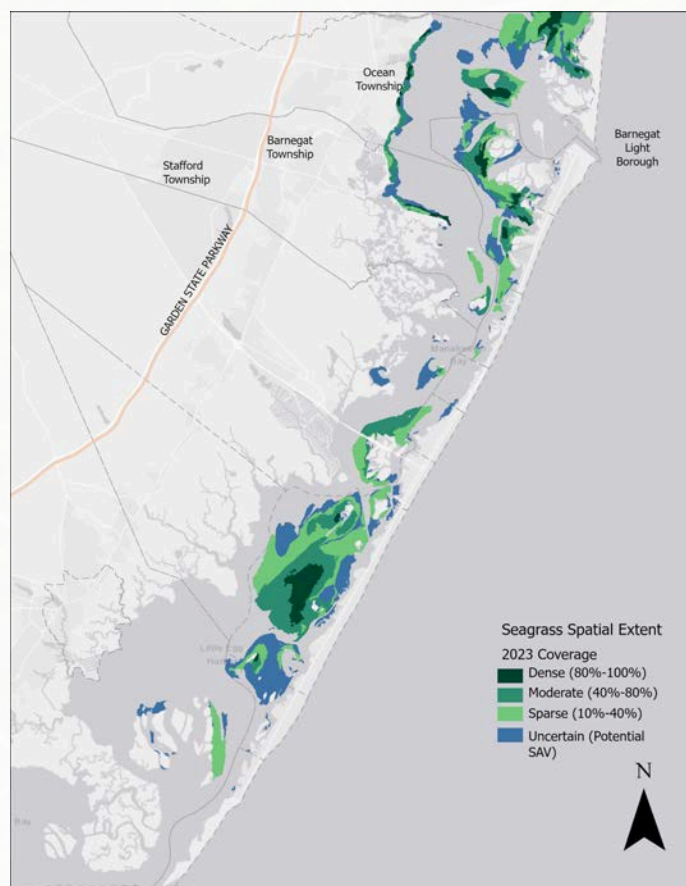
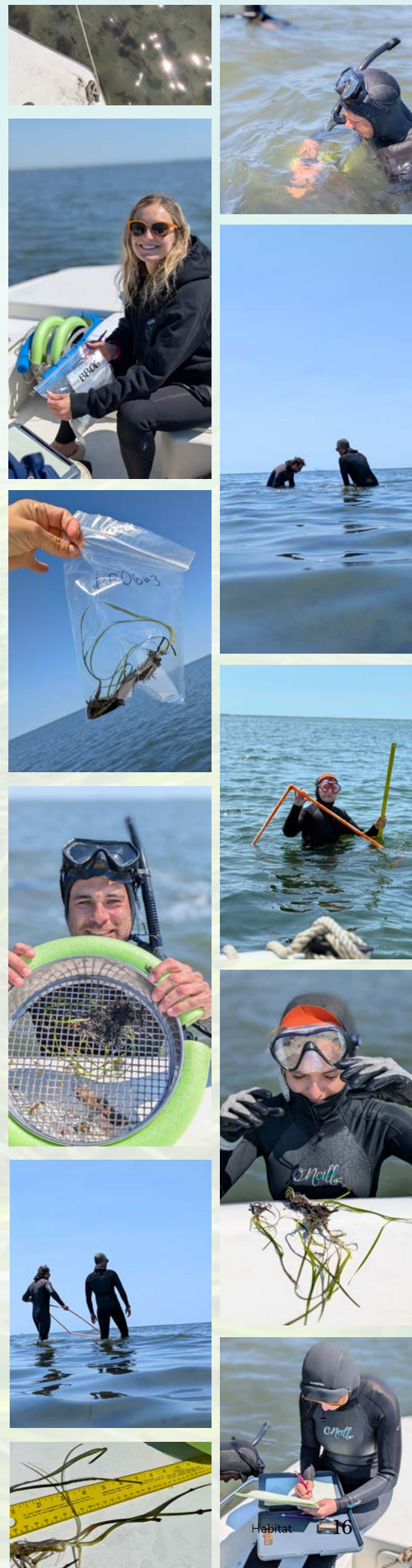


Figure 8. Extent of seagrass meadows (including eelgrass and widgeon grass) from Barnegat Inlet south to Little Egg Inlet.

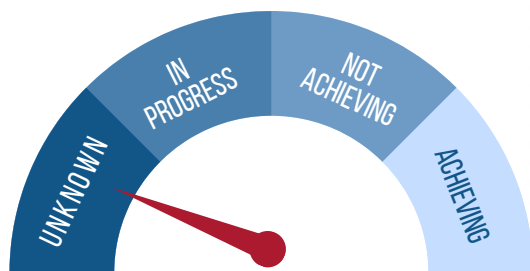


WETLANDS & RIPARIAN BUFFER

CCMP Priorities: Water Quality, Living Resources, Water Supply, Land Use

TARGET

Maintain or increase the current acreage of natural/vegetated upland buffers adjacent to all wetland and riparian corridors.



PROGRESS MADE

- Funding has been committed for updated mapping assessment of wetlands.
- Many areas for buffer enhancement have been identified.

INVESTMENT NEEDS

- Buffer enhancement (e.g., tree plantings, native plant borders) is essential on privately held lands.
- Private homeowners must be educated on responsible waterfront living practices.

BACKGROUND

Riparian buffers are the terrestrial zones directly adjacent or hydrologically connected to streams, lakes, and rivers. Characterized by frequent flooding and moist soils, these areas play a critical role in intercepting nutrient pollution before it reaches the bay's waterways. Healthy buffers feature uncompacted, undisturbed soils that allow rainfall to readily permeate the ground, supporting an abundance of native grasses, shrubs, and trees. This diverse vegetation forms a natural barrier that binds the shoreline, preventing banks from eroding or washing away. Above and below ground, the plants reduce flow velocities, trap sediments, anchor shorelines, and filter out excess nutrients to optimize water quality. During heavy storms, riparian zones absorb and slow rushing floodwaters, mitigating damage to nearby property. Furthermore, they provide essential forage, refuge, and nesting habitats for both aquatic and terrestrial wildlife, serving as vital movement corridors for resident and migratory species. Fallen leaves and insects from the canopy provide a foundational food source for aquatic life, while submerged branches and roots offer critical shelter for native fish.

Did You know?



Because of their role in filtering rainwater, buffers can be considered living filters. One acre of buffer can prevent up to 100lbs of nitrogen and 8lb of phosphorus from running into the waterways each year*.

*Chesapeake Bay Program Riparian Buffer Fact Sheet

PRIMARY INDICATOR: WETLANDS AND RIPARIAN BUFFER

STATUS

The current status remains undetermined pending the completion of a comprehensive, watershed-wide digital mapping assessment.

TREND

Without historical or current comprehensive digital mapping data for these buffer zones, evaluating a long-term environmental trend is not yet possible.

KNOWLEDGE GAP

Buffers are critical to the health of the estuary. Recognizing this importance, the Barnegat Bay Partnership has allocated funding to map regional riparian zones and establish a comprehensive baseline. This spatial mapping effort will identify fragmented or inadequate buffer widths to target for ecological enhancement, such as community tree and shrub planting events. Currently, many residential areas throughout the watershed feature expansive mowed lawns directly adjacent to narrow or degraded buffers. These lawns offer prime opportunities for habitat expansion and restoration. Because many of these grassy areas are seldom utilized, homeowners could also realize significant long-term cost savings by replacing high-maintenance lawns with expanded natural buffers that eliminate the need for routine mowing.

WHAT YOU CAN DO



Support the purchase of buffer areas to be used as open space.



Do not feed Canada geese and other nuisance wildlife.



Take part in community activities that enhance buffers.



Use native vegetation as a buffer on your property, and encourage HOA to host more plantings.

WETLAND PROTECTION

CCMP Priorities: Water Quality, Living Resources, Water Supply, Land Use

TARGET

Maintain overall extent of tidal wetland acreage (20,922 acres) as identified on the 2015 aerial imagery. Restore or enhance 10 acres of tidal wetlands impacted by erosion through nature/natural based strategies to limit further loss.



PROGRESS MADE

- Funds for wetland mapping and restoration have been obtained.
- Planning and permitting for several large (>10 acre) restoration projects is underway.

INVESTMENT NEEDS

- Beneficial use of dredged materials for marsh restoration is increasingly necessary.
- More living shoreline projects are necessary to reduce erosion of wetland edges and protect ecosystem services.

BACKGROUND

The wetlands surrounding Barnegat Bay provide vital habitat for commercially, recreationally, and ecologically important fish, shellfish, and wildlife. These ecosystems also yield critical protective services, dampening wave energy and storm surges during extreme weather while slowing the advance of floodwaters. Furthermore, wetlands optimize water quality by trapping sediments, filtering pollutants, and processing excess nutrients. Unfortunately, many of these habitats are deteriorating, severely compromising their ecological value. Shoreline modifications, such as bulkheads and riprap, alter wave dynamics and accelerate marsh edge erosion. Simultaneously, rising water levels and historic mosquito ditching lower marsh platforms, stress native vegetation, and create stagnant pools of open water. Compounding these issues, ongoing coastal development restricts the natural corridors necessary for wetlands to migrate inland.

PRIMARY INDICATOR: WETLAND AREA

When last assessed in 2015, the Barnegat Bay watershed contained approximately 20,922 acres of tidal wetlands and 65,630 acres of freshwater wetlands. While no updated data has been collected since that baseline, dedicated funds have recently been secured to completely remap the region's wetland systems over the next four years.

STATUS

The Stockton University Coastal Research Center completed the last comprehensive, bay-wide wetland survey in 2015. To update this baseline, the BBP and its regional partners are coordinating a new mapping initiative scheduled for completion within the next four years. Meanwhile, active habitat restoration remains underway across the watershed, including targeted projects within the Edwin B. Forsythe National Wildlife Refuge and on municipally owned marsh platforms, with additional stabilization efforts slated for the future.

TREND

Within the Barnegat Bay watershed, the total area of tidal wetlands decreased by approximately 2.7% between 1995 and 2015. Much of this loss stemmed from natural physical disruptions, such as edge erosion and wash-over events that buried marshes under sand. Concurrently, the extent of freshwater wetlands declined by roughly 2.2%, a loss primarily attributed to human alterations for residential and commercial development. While no updated mapping data has been collected since this period, these historical baselines underscore the dual threat of environmental and anthropogenic pressures on the watershed.

SECONDARY INDICATOR: WETLAND RESTORATION

STATUS

Since 2020, the U.S. Fish and Wildlife Service has restored 13 acres of salt marsh, successfully surpassing its initial 10-acre target. Looking forward, the Partnership plans to rehabilitate an additional 10 acres over the next several years at a marsh site in Point Pleasant. Complementing these regional efforts, several local municipalities and conservation groups are actively engaging in localized wetland restoration projects.

TREND

While long-term dataset monitoring for these restoration efforts is currently limited, regional momentum and strategic planning continue to grow. Multiple initiatives are taking shape within the Edwin B. Forsythe National Wildlife Refuge and along the western shores of the bay to ensure the long-term resilience of these vital habitats.

WHAT YOU CAN DO



Protect wetland soil and vegetation, and support land acquisition for mitigation.



Participate in Paddle for the Edge community data collection.



Maintain safe distances from wetlands to reduce wake impacts.

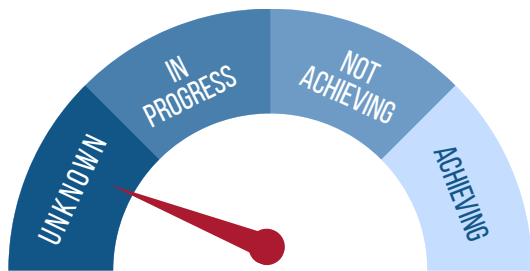


CLAM RESTORATION

CCMP Priorities: Water Quality, Living Resources, Water Supply, Land Use

TARGET

Return the hard clam abundance to the 1985/87 estimated population size of roughly **377,000,000** clams.



PROGRESS MADE

- Millions of clams have been planted in recent years.
- ReClam the Bay has established an effective volunteer base.
- A Hard Clam Management Plan is in development to guide the stock's continued recovery.

INVESTMENT NEEDS

- Regular stock assessments are vital to inform long-term clam management.
- Increased hard clam planting and assessment efforts are needed to improve survival and reproduction potential.

BACKGROUND

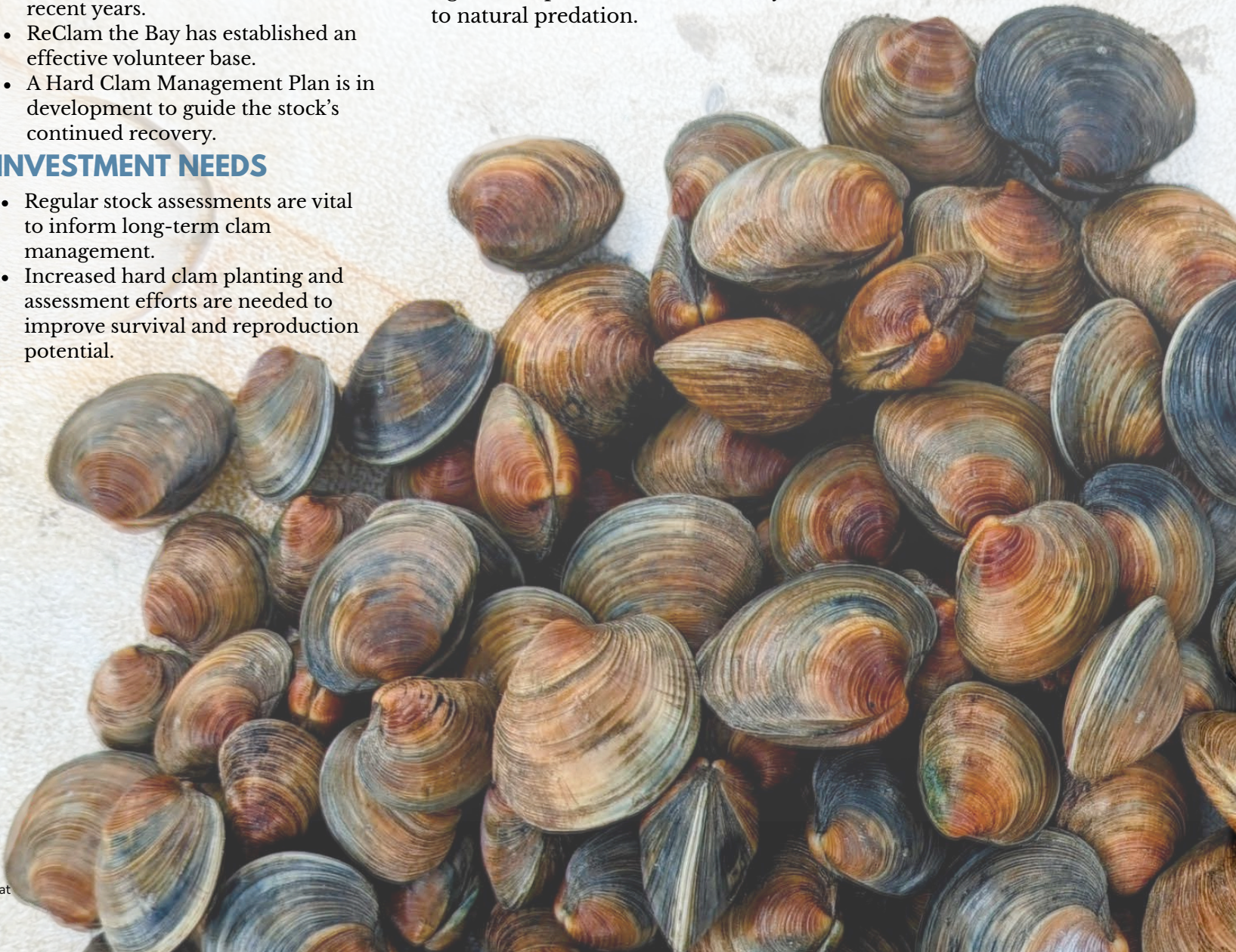
Hard clams are a commercially and recreationally important species that supports a valuable fishery. Because they are sensitive to shifts in water quality, they serve as an excellent indicator of the bay's overall health. Within Barnegat Bay, the majority of the wild harvest is now recreational, while commercial operations have transitioned primarily to aquaculture. At the peak of the bay's commercial fishery in 1879, clammers harvested an unprecedented 150,000 bushels of clams.

PRIMARY INDICATOR: HARD CLAM ABUNDANCE

STATUS

The last comprehensive, bay-wide stock assessment of hard clams was conducted in Little Egg Harbor (2011) and Barnegat Bay (2012), estimating a total standing stock of approximately 224 million clams (Figure 10). Because no regional population surveys have been executed since that period, the current abundance remains unknown.

Since 2006, the NJDEP and dedicated partners like ReClam the Bay have planted more than 7.5 million clams into the estuary (Figure 9). While their exact long-term survival rate is undocumented, most seeding has occurred within the highly accessible, approved waters of the Sedge Island Marine Conservation Zone; consequently, field managers assume a significant portion is harvested by recreational clammers or lost to natural predation.



TREND

With only two comprehensive, bay-wide surveys completed over the past 40 years, the existing dataset lacks the mathematical frequency required to determine a definitive long-term population trend.

KNOWLEDGE GAPS

Without regularly scheduled, bay-wide surveys, tracking the ongoing status and population trends of hard clams remains impossible. Furthermore, there is a total absence of data regarding wild harvests (both commercial and recreational) and incomplete documentation on cultured clam yields. To bridge these information gaps, the NJDEP is drafting a comprehensive Hard Clam Fishery Management Plan. This initiative aims to establish a framework of management and enhancement strategies to support long-term resource sustainability. Once finalized, the plan will provide the vital scientific data necessary to guide informed regulatory decisions and ensure the species' recovery. In the interim, the NJDEP and partners like ReClam the Bay will continue their annual planting efforts to supplement local stocks.

Hard Clam Abundance

Little Egg Harbor & Barnegat Bay

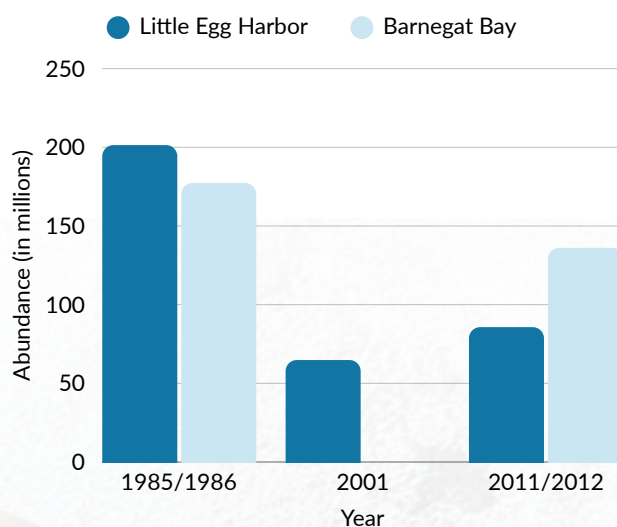
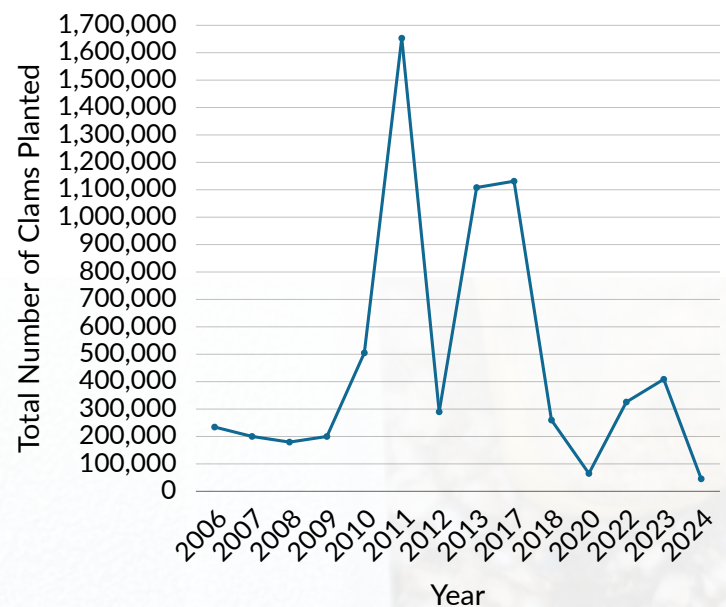


Figure 9: Hard clam abundance in Barnegat Bay estimated during NJDEP surveys.

Total Clams Planted Per Year



Courtesy of the NJDEP and ReClam the Bay

Figure 10: Total clams planted per year by ReClam the Bay.

WHAT YOU CAN DO



Buy locally sourced clams.



Follow all shellfish harvesting rules, including size limits.

ECOLOGICAL FLOWS

CCMP Priorities: Water Quality, Living Resources, Water Supply, Land Use

TARGET

Maintain flow levels at least 30% over minimum ecological flows for gauged waterways within the watershed.



PROGRESS MADE

- Phase One of establishing an ecological low-flow threshold has been completed.
- Funding for future phases (II and III) necessary for establishing a low-flow threshold has been obtained.

INVESTMENT NEEDS

- Improved knowledge of groundwater withdrawals is needed.
- Changing conditions emphasize the need for improved water conservation.

WHAT YOU CAN DO



Use native vegetation to reduce turf grass, and reduce water needs.



Follow watering guidelines, especially in drought.



Install rain barrels to capture water and reduce runoff.



Use water-saving appliances, check EPA's WaterSense program.

BACKGROUND

Approximately 590 million gallons of freshwater discharge into Barnegat Bay daily via more than 15 rivers, streams, and creeks. This freshwater input consists of two primary components: base flow and surface runoff. Base flow originates chiefly from groundwater, providing a stable, continuous supply.

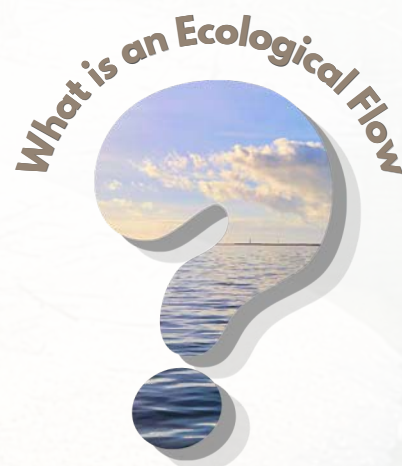
Conversely, runoff occurs intermittently when rainfall or irrigation sweeps across the landscape and drains into tributaries—a process accelerated during storms, particularly within developed areas. In pristine, undeveloped landscapes, runoff constitutes only a fraction of total streamflow. However, as urbanization expands, impervious surfaces multiply, significantly increasing the proportion of stormwater runoff. This shift diminishes groundwater recharge, and the resulting reduction in base flow can degrade water quality and destabilize aquatic habitats, impacting both ecological communities and local populations.

PRIMARY INDICATOR: STREAM FLOW

To track these dynamics, the U.S. Geological Survey (USGS) maintains a network of stream gauging stations that continuously monitor flow rates across the watershed's major tributaries, including Cedar Creek, Toms River, Westecunk Creek, and the North Branch of the Metedeconk River.

STATUS

Currently, no minimum ecological flow criteria have been established to evaluate streamflow trends. However, available monitoring data from water year 2024 reveals that steady base flow accounted for 72% to 96% of total discharge across the watershed's monitored waterways. Westecunk Creek exhibited the highest proportion of base flow (96%), followed closely by Cedar Creek (93%), Toms River (85%), and the North Branch of the Metedeconk River (72%). This spatial variation directly aligns with local land-use patterns, as groundwater-driven base flow consistently constitutes a higher percentage of the total water budget in less developed, less urbanized subwatersheds.



The amount of water needed to sustain the diversity of life and ecosystem function of a river or stream.

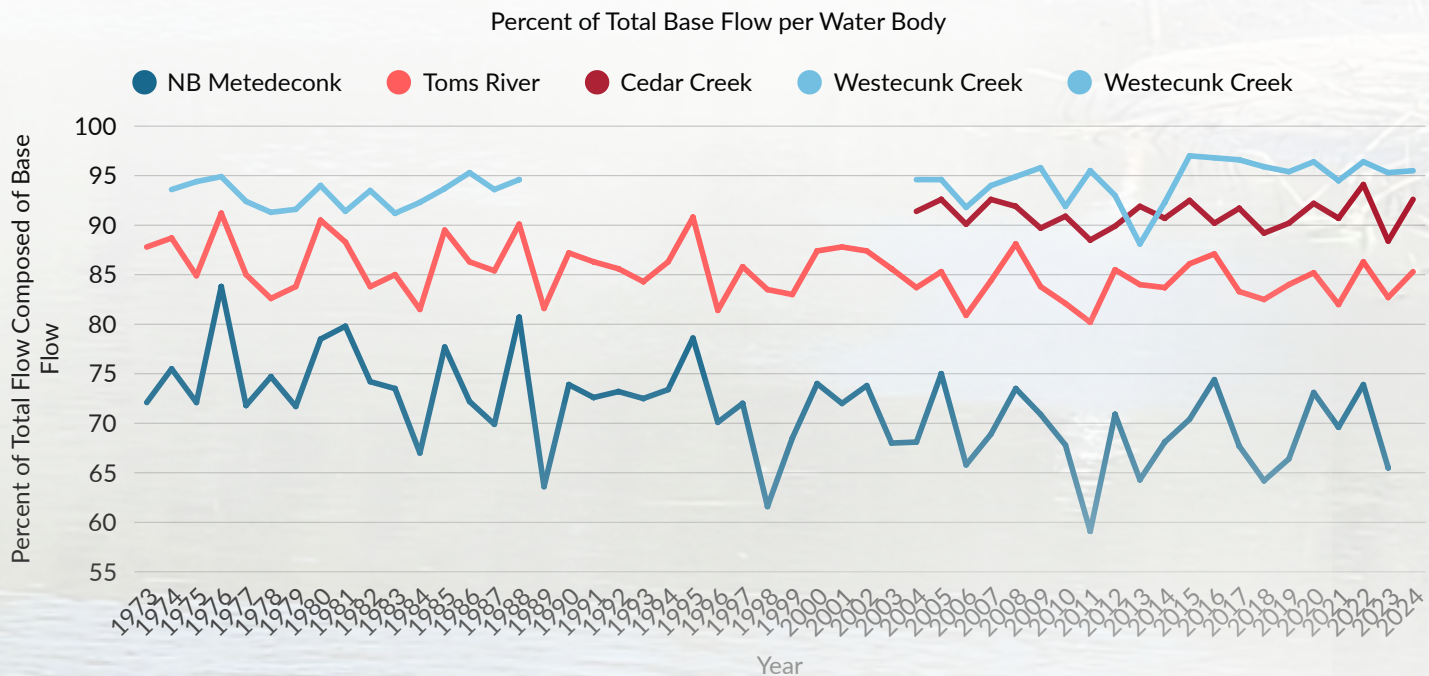


Figure 11. The percentage of total flow composed of base flow for the Westecunk Creek (light blue), Cedar Creek (dark red), Toms River (light red), and North Branch Metedeconk River (dark blue) from water years 1973–2024.

TREND

Assessing long-term streamflow trends remains challenging due to the current lack of established minimum ecological flow criteria. While monitoring records from 2004 through 2024 reveal a high degree of year-to-year variability in base flow, no uniform, watershed-wide trend is evident across all four streams. Looking at a broader historical window, however, a distinct shift emerges: over the last 52 years, the percentage of total flow sustained by base flow has significantly declined in both Toms River and the North Branch of the Metedeconk River—the two most heavily urbanized subwatersheds in the basin.

KNOWLEDGE GAPS

There are currently no minimum ecological flows established for the gauged waterways in the Barnegat Bay watershed. Without these criteria, it is not possible to determine whether flow goals are being met.

Although no minimum ecological flows have been set for streams in the watershed, the US Geological Survey completed a 2025 study comparing streamflow statistics from two historical periods (1933–1988) with a recent period (2004–2020) for four major streams (Figure 11). The study analyzed monthly, seasonal, and annual low-flow patterns, streamflow trends, and land-use changes to better understand watershed flow conditions. This work provides a foundation for developing ecological flow targets in the Barnegat Bay watershed.





WATER CONSERVATION & REUSE

CCMP Priority: Water Supply

TARGET

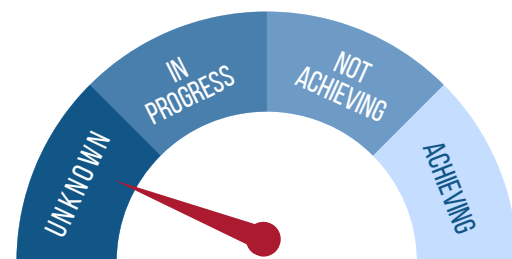
Reduce five-year rolling average water withdrawals to 10% below the 2010 estimate of 85.56 million gallons per day (MGD).

PROGRESS MADE

- Per capita water usage has declined as water-saving appliances and water-saving practices such as rain barrels and native plants have been effective.

INVESTMENT NEEDS

- We must further reduce per capita water use to offset coastal population growth.
- Water from small wells must be tracked.
- Increased water reuse efforts are necessary.
- We need new USGS estimates of withdrawals.



BACKGROUND

Humans depend on freshwater for drinking, agriculture, irrigation, and industrial processes. Similarly, adequate freshwater inputs are essential to support local wildlife, sustain native plant communities, and maintain the bay's delicate chemical balance. When freshwater inflows decrease, salinity levels spike, altering local species distributions. Consequently, balancing the water needs of both society and the environment is critical. Excessive water consumption depletes local ecosystems and, when coupled with low rainfall or drought, poses severe threats to both human communities and the estuary. Prioritizing water conservation and recycling helps safeguard these vital resources for future generations.

Potable water which is safe for drinking, cooking, and cleaning comprises the largest portion of water used in Ocean County.

After use, most of this supply is collected by sewer systems and piped to centralized treatment plants, where it is processed and subsequently discharged into the Atlantic Ocean.

Rather than treating this effluent as waste, numerous possibilities exist to implement and expand regional water reuse programs. Diverting treated wastewater for purposes that do not require drinking-quality water maximizes this finite resource. Practical examples include utilizing captured stormwater for landscape irrigation, repurposing industrial wash-water for street cleaning, cycling cooling water at utility plants, or routing greywater for toilet flushing. This loop conserves pristine groundwater reserves and slashes the energy footprint required to treat both potable water and wastewater.



Taking proactive steps in municipal water conservation, Brick Township recently installed an Aquifer Storage and Recovery (ASR) well. This specialized infrastructure injects treated water into underground aquifers during periods of excess supply (such as wet seasons) and recovers that same water to augment the public supply during peak summer demand or prolonged drought.

PRIMARY INDICATOR: WITHDRAWALS

STATUS

The most recent USGS assessment of water withdrawals in Ocean County occurred in 2015, estimating usage at 89.46 million gallons per day—approximately 12% above the baseline target, resulting in a status designation of “not achieving.”

Concurrently, the NJDEP tracks annual consumption by monitoring permitted extraction volumes. These metrics inherently underrepresent true water usage, as reporting is only mandatory for allocations exceeding 100,000 gallons per day. Furthermore, this dataset excludes water imported from Monmouth County to support developed communities in northern Ocean County. While the NJDEP recorded 68.36 million gallons per day in 2010, the five-year rolling average from 2020 through 2024 rose to 72.03 million gallons per day. Consequently, it is highly probable that total regional consumption remains above the 2010 management target (Figure 12).

TREND

While water withdrawals were expanding and driving a worsening trend when last evaluated in 2015, a lack of recent monitoring data leaves the current trajectory unknown. This prolonged absence of updated information constitutes an increasingly critical data gap.



Biosolids from wastewater are processed at an Ocean County Utility Authority plant and converted into an award-winning fertilizer called OceanGro.

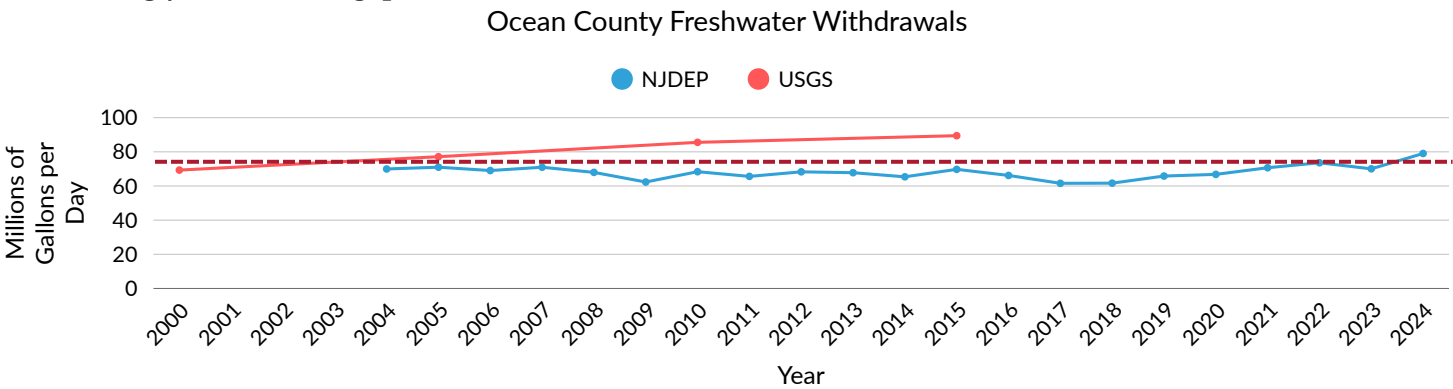


Figure 12: Water withdrawals in Ocean County as reported by the NJDEP (blue) and estimated by USGS (light red). The dashed (dark red) line demonstrates the target.

SECONDARY INDICATOR: WASTEWATER FLOW AND WATER REUSE DATA

STATUS

All wastewater from sewered areas in Ocean County is treated by the Ocean County Utilities Authority, which tracks treatment volumes over time. This does not include water used for personal, irrigation, or industrial purposes in unsewered areas (e.g., many communities in the Pinelands). There are approximately 22,500 septic systems which do not contribute to the tracked wastewater totals. From 2020 through 2024, per capita wastewater flow averaged 79 gallons per day (Figure 13).

Water reuse efforts averaged about 1.9 billion gallons per year during 2020–2024, and have remained relatively steady since 2013 (Figure 14). In three of the last five years, reuse exceeded 2 billion gallons, supporting activities like fire protection, irrigation, and industrial processes.

TREND

Per capita wastewater has declined over the past 20 years, showing that water conservation measures, like installing water-saving appliances, have been effective. However, total wastewater flow has remained steady, as population growth has offset individual reductions.

The NJDEP 2017–2022 New Jersey Water Supply Plan projects that the state will have sufficient water if conservation and reuse continue. The plan estimates that an additional 3.4 million gallons per day or about 1.2 billion gallons per year, could be saved in the Barnegat Bay watershed through further conservation. Water reuse has been steady over the past decade.

KNOWLEDGE GAPS

Due to outside water being brought into Ocean County, and no reporting required for withdrawals less than 100,000 gallons per day, water withdrawals may not accurately reflect water use in Ocean County. Likewise, updates to the USGS estimates have not yet been completed, and the current estimates are outdated, with the last update ten years ago.

Water withdrawal data comes from NJDEP self-reports, and is estimated by USGS. Groundwater diversions below 100,000 gallons per day are not required to be reported to NJDEP, leading to an undercount of total groundwater diversions and a disparity between NJDEP's and USGS's figures for water use. It is important that these “small” groundwater diversions be monitored for accurate estimates of water withdrawal and infrastructure planning going forward.

While wastewater flow is a stable metric of domestic water use, it does not capture non-sewered areas, which are common throughout the watershed.

WHAT YOU CAN DO



Install a rain barrel under a roof downspout and collect rain water for use in the yard.



Use weather- or soil moisture-based irrigation controllers. Look for EPA WaterSense labeled products for guaranteed efficiency.



Plant drought-resistant turf (like tall fescue) and replace unused lawn with swales to capture runoff.



Consider use of porous surfaces on driveways, walkways, or patios.



Get your yard Jersey-Friendly-Yards Certified by planting drought tolerant native vegetation.



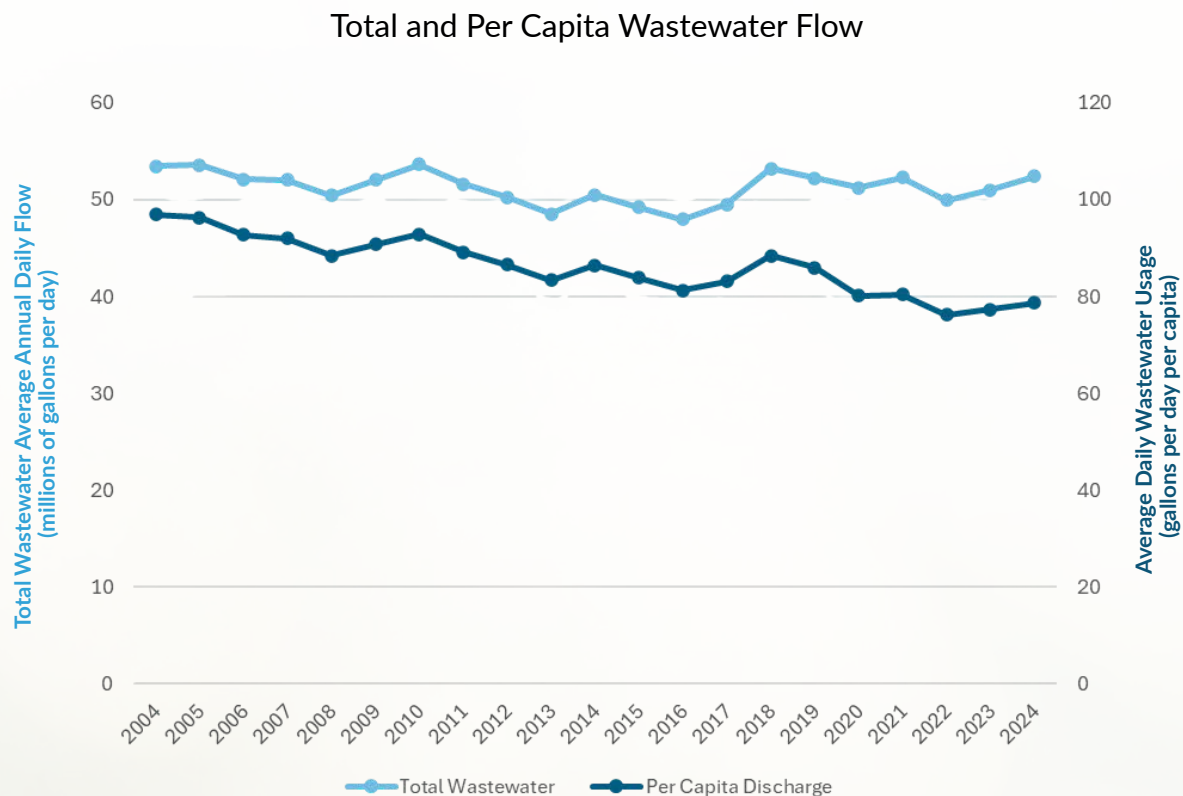


Figure 13: Total wastewater flow (light blue) and per capita wastewater flow (dark blue) for Ocean County from 2004 to 2024.

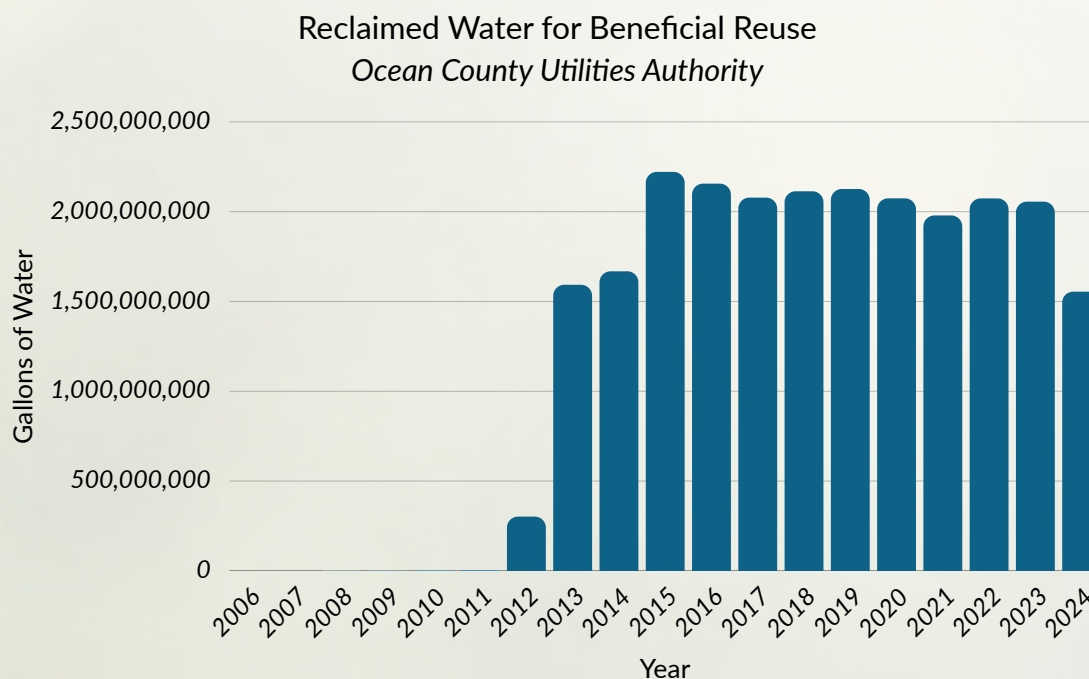


Figure 14: The amount of water reused by the Ocean County Utilities Authority as part of their wastewater processes from 2006-2024.

ENVIRONMENTAL CONDITIONS

Weather directly and indirectly affects human and natural communities in many ways. Air temperatures influence water temperatures, which affect many species' extent and timing of movements, growth, reproduction, and physiology. Precipitation affects the movements of water and materials on and across the landscape, with adverse (e.g., nutrient runoff) and beneficial (e.g., groundwater recharge) consequences to the ecology of the bay. Changing water levels have important implications for the function of our marshes and our coastal communities. The following indicators highlight some of the changing conditions in the bay and its habitats.

AIR TEMPERATURES

A review of more than 130 years of temperature data from Ocean County reveals that over two-thirds of the warmest months on record have occurred within the past three decades—a disproportionate concentration given that this period represents only 23% of the historical record. Remarkably, since 2000, ten out of twelve months (February through August, alongside October, November, and December) have experienced their absolute warmest individual months on record (Figure 15). Conversely, no historically cold month has been registered since 1989. These compounding thermal shifts are actively altering both terrestrial and aquatic ecosystems, including the delicate habitats of the bay.

Rising air temperatures significantly alter ecological distributions, creating welcoming environments for southern species to migrate northward while displacing cold-adapted native species further north. This shift can accelerate the spread of invasive species and destabilize local communities, causing once-abundant native organisms to become increasingly rare over time.

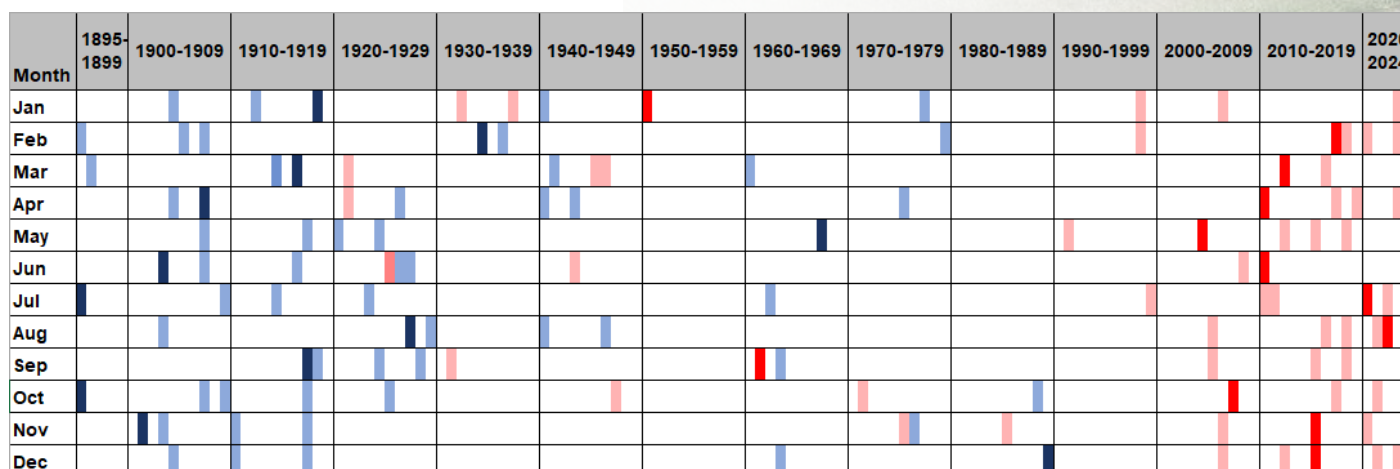


Figure 15: Historical monthly temperature extremes (1895–2024), where each bar represents a single month within a year. Data provided by the Rutgers Office of the State Climatologist.

Each row in this graph represents the same month over different years spanning from 1895–2024. Each row includes the single lowest average temperature (■), the five lowest average temperatures (■), the five average warmest temperatures (■) and the single warmest average temperature (■) over time for each month.

PRECIPITATION

Rainfall patterns across the watershed dictate nutrient loading, debris pollution, groundwater recharge, streamflow, and localized flooding—dynamic shifts that profoundly impact both human and ecological communities. Heavy precipitation events have grown increasingly frequent, evidenced by a significant long-term rise in the number of days receiving an inch or more of rain (Figure 16). When intense downpours are superimposed on rapid coastal development and expanding impervious cover, they generate severe stormwater surges, presenting worsening and chronic flooding challenges for many coastal municipalities.

PRECIPITATION [CONTINUED]

Expanding precipitation across an increasingly developed, impervious landscape accelerates the delivery of nutrient pollution to the bay via stormwater runoff. This trend significantly escalates both the structural necessity and financial cost of regional stormwater management. Paradoxically, despite the rise in severe downpours, Ocean County has also recently endured prolonged periods of drought. This duality underscores the highly volatile, episodic nature of modern weather patterns, demonstrating that short-term localized conditions may not mirror long-term trends.

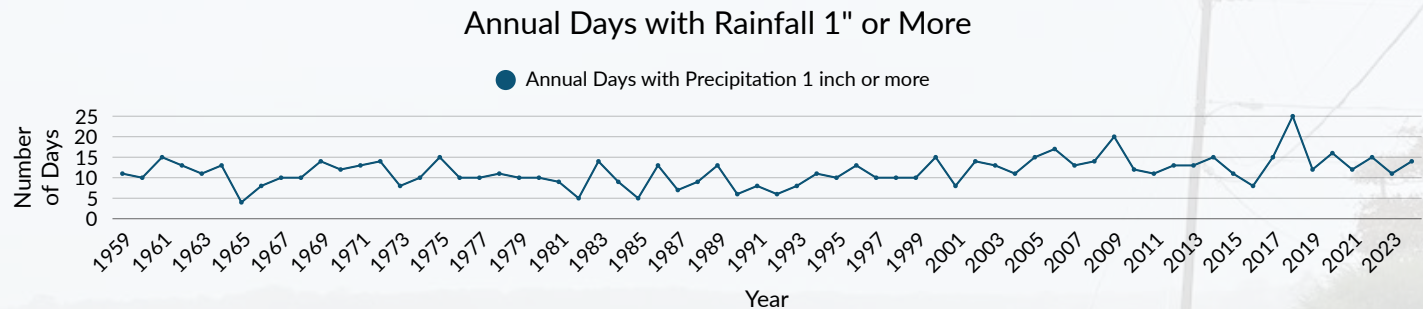


Figure 16. Annual days with rainfall 1" or more at Atlantic City Airport. Data provided by the Rutgers Office of the State Climatologist.

SEA LEVELS

Data from NOAA indicate sea levels at the Atlantic City gauge have increased on average 4.25 mm per year (Figure 17). This rise has already impacted marshes across the watershed, changing how often and how long they are inundated. The developed landscape has also felt these changes. New rules proposed in New Jersey would require resilient design and construction in zones that are projected to be flooded in the future.

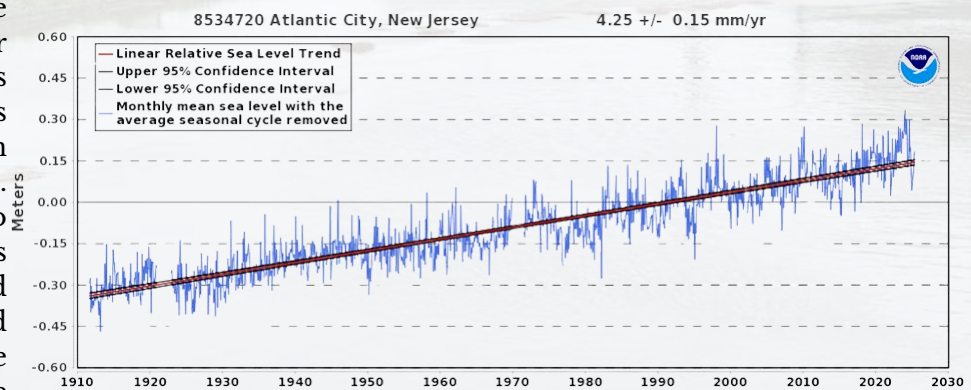
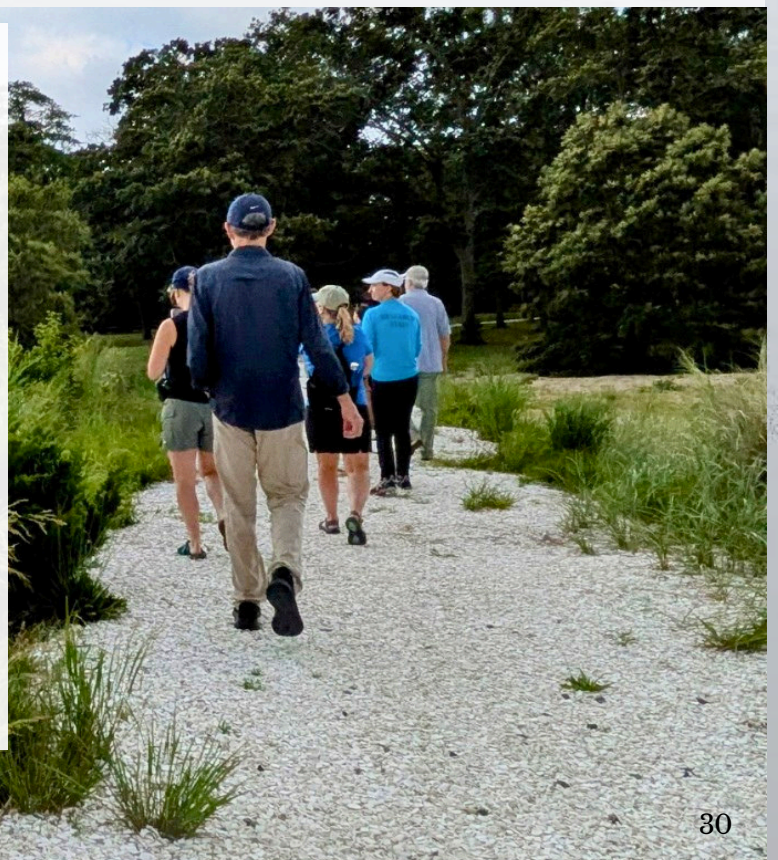


Figure 17 Sea level through time at the Atlantic City gauge. Data provided by NOAA Tides and Currents.

THE PROBLEM WITH NITROGEN

Nitrogen is an essential nutrient for the estuary, but excessive amounts can severely impact the plants and animals that call the bay home. It originates from numerous upstream sources, including lawn fertilizers, wastewater, animal waste, and even car wash detergents. Locally, the vast majority of this nutrient load is delivered to our waterways through stormwater runoff. Once in the bay, nitrogen is rapidly consumed by aquatic algae and plant life; however, an overload can trigger massive algal blooms that deplete dissolved oxygen levels, threatening fish, seagrasses, and shellfish. Following decades of chronic nutrient loading, reducing these inputs has become a top priority. Establishing an effective reduction framework begins with defining an empirical baseline—a task that required over 15 years of rigorous research and modeling. A finalized target level has now been established for the bay, providing a clear roadmap for long-term water quality recovery.



Establishing a Total Maximum Daily Load Pollution Budget for Barnegat Bay to Achieve a Nitrogen Water Quality Standard: We're Almost There!

PHASE ONE: IDENTIFYING DATA GAPS AND PROVIDING A SCIENCE FOUNDATION

Beginning in 2010, the New Jersey Department of Environmental Protection (DEP) hosted a series of public meetings to engage stakeholders in collaboratively developing an action plan for the 660-square-mile Barnegat Bay watershed. These meetings culminated in the announcement of the Ten Point Plan. Under Phase One of this initiative, the DEP launched parallel long- and short-term strategies to assess and protect local water resources. The long-term agenda included adopting a more rigorous water quality standard, decommissioning the Oyster Creek Nuclear Generating Station, funding comprehensive research, and constructing an estuarine water quality model. Meanwhile, short-term actions provided municipal compliance assistance, reduced fertilizer nutrient pollution through targeted education and enforcement, and secured state-acquired land within the watershed. Much of Phase One focused on systematically analyzing the condition of the estuary and its drainage basin by gathering extensive water chemistry, biological, and sediment data. This dataset ultimately fueled the development of hydrodynamic and water quality models used to establish the total nitrogen (TN) target concentrations required to protect sensitive aquatic species. From 2011 to 2014, the DEP funded ten multi-year research projects to evaluate the bay's ecology, aiming to bridge key knowledge gaps, improve water quality, and advance habitat restoration. These combined findings yielded one of the most comprehensive scientific compilations for a single estuary in the nation: the Fall 2017 Journal of Coastal Research Special Issue #78, *A Comprehensive Assessment of Barnegat Bay-Little Egg Harbor, New Jersey*.

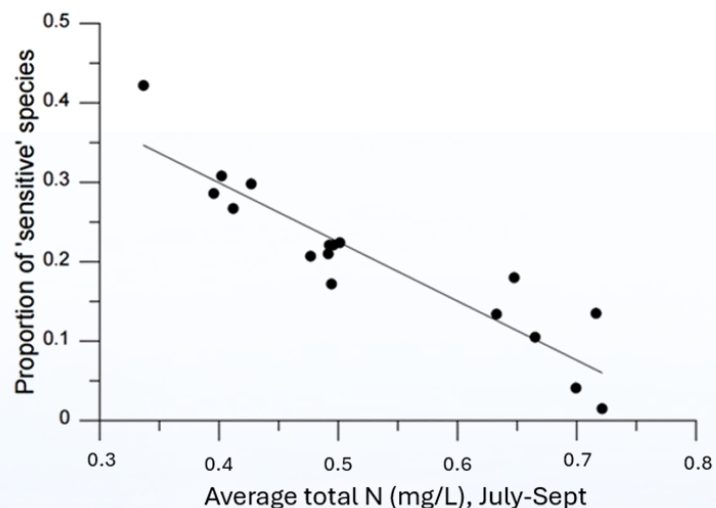


Figure 18: Correlation between summer average TN concentration and the proportion of sensitive macroinvertebrate species identified by Taghon et al. (2017).

ESTABLISHING A WATER QUALITY STANDARD

While all of the published research significantly improved our understanding of the estuary, two Phase One studies provided the critical data needed to develop a rigorous water quality standard. First, a benthic macroinvertebrate study by Taghon et al. (2017) identified a strong correlation between total nitrogen (TN) concentrations in the water column and the abundance of pollution-sensitive species (Figure 18). As indicator organisms, the presence or absence of these benthic macroinvertebrates directly reveals the health of their aquatic environment.



To be protective of a healthy macroinvertebrate community as identified in Taghon et al. (2017), the DEP chose 0.45 mg/l (summer average, July 1-September 30) as the site-specific criterion for Barnegat Bay. This value also aligns with thresholds set in other estuaries. The TN criterion derived for Barnegat Bay is intended to support healthy benthic macroinvertebrate communities, which form the base of the aquatic food web and thus are integral to overall aquatic ecosystem health. The establishment of a site-specific TN criterion and the total maximum daily load (TMDL) process will fulfill the Phase One directive to develop a rigorous water quality standard. The establishment of site-specific criteria for a waterbody is supported by the State's nutrient policies, a component of the N.J. Surface Water Quality Standards (N.J.A.C. 7:9B-1.15(g)2). The policy allows for the development of watershed-specific numeric translators as part of developing a TMDL.

Equally if not more important, the U.S. Geological Survey (USGS) also "coupled" complex hydrodynamic (ROMS) and water quality (WASP) models, which accurately simulated the nutrient concentrations throughout the bay responding to nitrogen loads and reductions from major sources throughout the watershed (DePaul, 2025). The ROMS-WASP model developed by USGS for Barnegat Bay simulated water quality conditions from March 7, 2012 to September 30, 2012. A Model Evaluation Group was engaged in 2019-2020 to provide an independent and objective review for determining the adequacy of calibration, strengths and weaknesses of the calibrated model, and subsequent usability of the model for TMDL and site-specific criteria development and other DEP management decisions. They concurred that the model served as a reasonable representation of spatial and temporal distributions of salinity, nutrients, and chlorophyll a. Based on the calibrated model, the northern part of the bay exhibited summer average (July 1-September 30) concentrations exceeding 0.45 mg/L, while the southern part of Barnegat Bay had concentrations less than 0.45 mg/L. The northern part of the bay would be considered as impaired for TN using 0.45 mg/L as the threshold because it does not meet the site-specific TN criterion.

The published model provided the foundation for establishment of the TMDL of nitrogen for the bay and for future actions to protect and restore the Bay's living resources. The Strategy laid out short-term through long-term timeframes for implementable actions that would improve the overall ecological health of the Bay.

PHASE TWO: RESTORING, ENHANCING, AND PROTECTING THE BAY

Building upon the accomplishments of Phase One, the Barnegat Bay Restoration, Enhancement and Protection Strategy (REPS, Strategy, or Phase Two) was shared with the public in October 2017. The Strategy highlighted the Phase One results to establish a total nitrogen (TN) and TMDL for the Bay and laid out timeframes for actions to improve the overall ecological health of the Bay. The Barnegat Bay TN TMDL, essentially a "pollution budget", establishes the nonpoint source (NPS) load reductions needed achieve the target nitrogen water quality standard for the Bay.

In 2018, the DEP provided up to \$10 million through a combination of low interest loans and grants to begin the implementation of the Strategy: see <https://dep.nj.gov/wlm/grants/funded-projects/> for projects funded and completed. The funded projects serve as a foundation for efforts to reduce nutrient loadings to the bay.

The DEP held three stakeholder meetings (November 2023, January 2024, and October 2024) to publicly share and discuss the Phase One findings, the specific load reductions that would be required from both the northern and southern parts of the watershed to lower nutrient concentrations in the north and prevent exceedances of loadings in the south, and the preliminary Phase Two efforts. The recordings of these sessions may be viewed at <https://www.nj.gov/dep/barnegatbay/>.

The culmination of this work over more than 15 years and other measures will be encompassed in the TMDL Implementation Section of the forthcoming TMDL report to be released by the DEP later this year. The Barnegat Bay Nitrogen TMDL will establish site-specific TN criterion for the bay and require loading reductions from nonpoint sources serving as a vital tool for stakeholders to implement to improve ecological health of the bay.

The DEP and the BBP thank the many partners, stakeholders, and members of the public who have contributed to the development of this comprehensive effort to better understand, protect, and restore the Barnegat Bay-Little Egg Harbor estuary and its watershed.

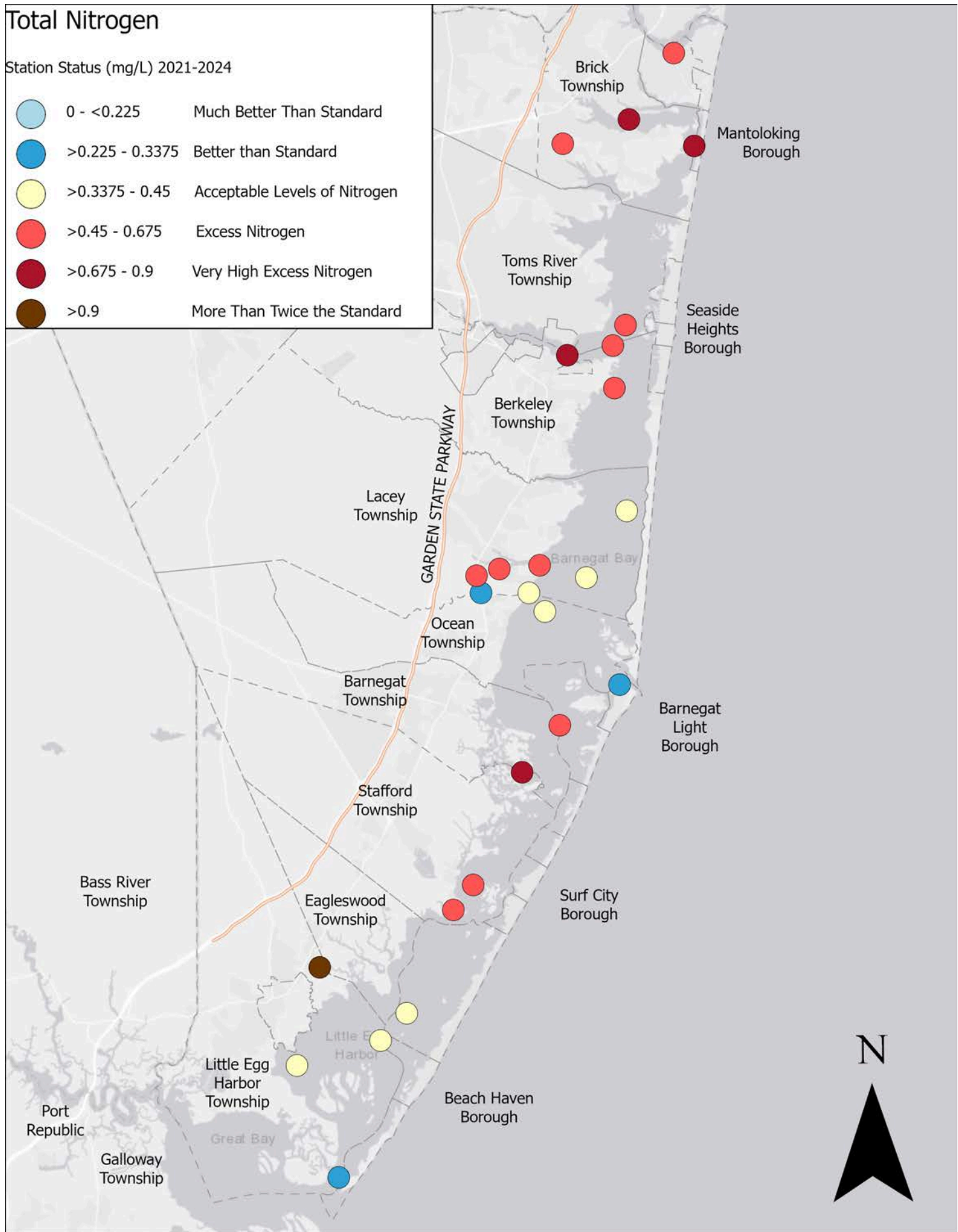


Figure 19. Total Nitrogen status (mg/L) and trends.

HOW DOES CURRENT WATER QUALITY COMPARE TO THE PROPOSED TMDL?

Figure 19 depicts average Total Nitrogen concentrations from 2021 through 2024 using data collected during the critical summer months from July through September. This station status serves to gauge typical summer nutrient levels across the estuary. For historical context, stations with sufficiently long data records were also analyzed to detect long term shifts in Total Nitrogen.

The findings reveal that areas near the ocean inlets generally meet the proposed Total Maximum Daily Load because frequent tidal exchange with the Atlantic Ocean dilutes localized nutrient buildup. Conversely, regions further from the inlets, which experience minimal ocean flushing and heavy stormwater runoff from surrounding tributaries, exhibit much higher nitrogen concentrations. Multiple sections of the estuary, particularly within the northern bay, fail to meet the proposed nitrogen standard, strongly underscoring the urgent necessity of a formalized management plan.

Crucially, trend analyses show that no monitoring stations are experiencing significant degradation over time. This stabilizing trend is a remarkable milestone and a direct testament to the coordinated mitigation efforts enacted by local municipalities, state and county agencies, environmental organizations, and dedicated residents. However, substantial work remains, especially in the vulnerable northern basin. While conditions have successfully stabilized, no stations are yet showing definitive improvements in water quality. Nevertheless, the formal adoption of the new regulatory limits will provide the framework and resource support needed to drive future initiatives to reduce nitrogen.



A NOTE FROM BBP'S FORMER DIRECTOR

"In the absence of past information or experience with historical conditions, members of each new generation accept the situation in which they were raised as being normal. In the environmental field this is usually associated with people's accepted thresholds for environmental conditions continually being lowered."

Mark Tedesco, Long Island Sound Study Director, June, 2025

Since the BBP is part of a national program, I thought it appropriate for one retired NEP director to draw some parallels with another recently retired director's observations in another NEP. To establish a record of environmental change and any progress, one requirement of all National Estuary Programs is a periodic assessment of the condition of each estuary of national significance and its resources. The BBP and its partners assembles a team of technical experts from its Science and Technical Advisory Committee to produce a report every five years. Essentially, this periodic synthesis of the best available monitoring information provides an update on environmental conditions to inform the public, guide management decisions, and provide a measuring stick of our collective efforts to protect and restore the estuary.

During the BBP's first three evaluation periods (2005, 2011, and 2016), the focus of the collective efforts was to pull together most, if not all environmental monitoring information collected by many different organizations for many different purposes. This shotgun approach (including up to 18 different indicators) was informative in some ways, but was recognized as increasingly expensive to maintain and somewhat inefficient. In addition, the various partner monitoring programs and assessments were sometimes dropped or replaced with different programs with different metrics. Most importantly, the many different programs did not provide a holistic perspective of the overall condition of the estuary.

With the development of the BBP's 2021 Comprehensive Conservation and Management Plan (CCMP), the BBP worked with its partners to identify broad, holistic ecosystem targets, with each target spanning and integrating conditions in different priority areas. Thus, each target is potentially responsive to environmental improvements from actions in different priority areas. To avoid the need for new monitoring and assessment programs, we focused on indicators using currently available data which were components of existing, long-standing monitoring programs. The targets represent double-edged swords, guarding against future loss or degradation and also working toward future restoration or other improvements.

Now that we have been using these holistic targets as a guide over a ten-year period (2017-2026), the news is definitely not all good, but signs of progress offer some encouragement. Because the NEP was established via the Clean Water Act, I think it fitting to begin and end with water quality.

NOT ACHIEVING: PUBLIC BAY BEACH OPENINGS AND CLOSURES

While some bay beaches improved over the ten-year period and most are "routinely" safe for swimming, several bay beaches (most notably Beachwood) were closed more frequently and need additional pathogen source-tracking and problem identification. A recently completed, DEP-funded study by Clean Ocean Action and other organizations may offer insights regarding further actions. Other potential lake and bay swimming areas (e.g., Windward Beach in Brick), currently closed to the public, require additional investment in stormwater management.

NOT ACHIEVING: ACREAGE OF APPROVED SHELLFISH HARVEST AREAS

Approved shellfish harvest areas showed little change from 2016–2021, but showed a greater decrease from 2021–2026. This decrease represents a loss of previously approved areas. NJDEP efforts are ongoing to pinpoint the sources and identify other contributing factors, but additional problem resolution appears needed. The issues affecting this indicator have taken on greater urgency with the continuing development of the shellfish culture industry throughout the BB-LEH estuary.

DATA GAP: WATER CONSERVATION AND RE-USE

The status of this indicator is unknown but is likely not being achieved, consistent with its status in the 2021 report, as a result of continued population growth and development throughout the watershed post-Sandy. The USGS has not completed its latest update (due to personnel losses), but available NJDEP data estimates suggest that we are not achieving the BBP's water conservation target (85.56 mgd withdrawal). Estimating water usage is compounded by some specific knowledge gaps (e.g., small groundwater-well data). The NJDEP's 2024 Water Supply Master Plan predicts that: 1) the watershed's population will continue to increase, and 2) overall water availability in the watershed will likely decrease for several reasons.

Thus, addressing data gaps and expanding conservation (e.g., planting native plants, using rain barrels and vegetated swales to reduce lawn watering, WaterSense appliances) and education measures (e.g., the Pineland Alliance's Save the Source campaign) to reduce water usage are especially needed.

PROGRESS WITH A DATA GAP: ECOLOGICAL MINIMUM FLOWS

The human population along the coast continues to grow; in addition, much of New Jersey has been experiencing various and somewhat prolonged drought conditions. These factors will continue and increasingly cause a strain on water supplies. To ensure water for people and the bay's living resources. The BBP is funding a major USGS study to develop ecological flow targets in the Barnegat Bay watershed. The first phase of that USGS effort, which identifies low-flow conditions in select Barnegat Bay tributaries, was recently published. That report compared streamflow statistics between historical and current time periods to understand trends in watershed flow conditions, which provides a foundation for next steps developing ecological flow targets in the Barnegat Bay watershed. The BBP has obtained and committed nearly \$450K in IJA funding to complete the remaining phases of the study.

PROGRESS WITH TWO DATA GAPS: WETLAND PROTECTION AND WETLAND/RIPARIAN BUFFER PRESERVATION

There were no data available at the time of the 2021 report to conduct either of these analyses. Recently, the BBP has obtained IJA funding to initiate both the wetland and buffer acreage assessments in the next year. Although the rates of wetland and buffer losses had previously slowed due to federal and state regulations which restrict development, storms have more recently been identified as causes of wetland losses. With regard to wetland restoration, it should be noted that several large ongoing projects (>10 acres) will attain the BBP's goal for wetland restoration (i.e., 10 acres). This suggests that the wetland restoration goal should be reconsidered (i.e., increased). With regard to buffer restoration, several ongoing projects will result in nature-based shorelines in place of bulkheading and other hardened shorelines. In addition, riparian "improvement" projects have been identified through NJDEP-funded watershed management plans. The NJDOT has developed a regional sediment management framework to promote the reuse of dredged materials for wetland restoration; USACE, NJDEP and various resource agencies are also promoting reuse.

PROGRESS WITH A DATA GAP: HARD CLAM ABUNDANCE

The Barnegat Bay used to support a thriving commercial harvest of hard clams, *Mercenaria mercenaria*. Regular surveys of hard clam abundance (=stock assessment), which are both commercially and recreationally harvested, are essential for sound management of the hard clam population in the Barnegat Bay. Unfortunately, the hard clam stock in the bay has not been assessed since 2012. The NJDEP, the BBP, and a number of partner organizations are collaboratively developing a Hard Clam Management Plan, which presumably will require that a robust survey/ stock assessment be conducted periodically. Several groups, most notably Reclam the Bay, "plant" juvenile clams (reared in upweller facilities at various locations around the bay) for restoration purposes. The BBP has also funded research projects to potentially support clam management and restoration.

PROGRESS WITH A DATA GAP: SUBMERGED AQUATIC VEGETATION (SAV)

SAV beds comprise one of the bay's most critical aquatic habitats, and Barnegat Bay is home to most of the state's remaining beds (mostly eelgrass, *Zostera marina*). The NJDEP and BBP have funded researchers at Rutgers and Stockton universities to map and field verify the acreage of SAV beds in Barnegat Bay. Some technical issues have necessitated additional work to resolve the uncertainty in the maps upon which the current acreage estimates will be based. Presently, it is unclear if the acreage has increased or decreased from the previous estimates.

PROGRESS (!) ABOUT THE BAY'S WATER QUALITY

For the past 15 years, the NJDEP has been supporting baywide water quality monitoring, other studies, and various modelling efforts to develop a nitrogen water quality criterion protective of the bay's aquatic life. While not yet adopted, the NJDEP will soon propose a Total Maximum Daily Load of Nitrogen (TMDL) which represents a culmination of work by the NJDEP, USGS, the BBP, and many other partners to establish a nutrient load and water quality criterion. The TMDL is unique in establishing different load reductions for different parts of the bay. Studies in other systems suggest changes in land practices may take a decade or more to manifest improvements in the Bay's waters. Perhaps most interestingly, water quality stations in Barnegat Bay have not gotten any worse in the past 10 years. To learn more about this interesting observation and what you can do to protect the bay, please read the report.



ACKNOWLEDGEMENTS

This report is possible thanks to the significant contributions of the Barnegat Bay Partnership's **Scientific and Technical Advisory Committee** members, the **Advisory Committee** members, and the **numerous partner organizations** which contributed information on relevant monitoring and modeling projects within the watershed.

ADVISORY COMMITTEE

Andrew McGowan, Co-Chair	Barnegat Bay Partnership
Karen Greene, Co-Chair	NOAA Fisheries Habitat Conservation Division
Keith B. Marcoon	Ocean County Utilities Authority
Robert Shertenleib	Ocean County Utilities Authority
Peter Blum	U.S. Army Corps of Engineers
Monica Chasten	U.S. Army Corps of Engineers
Tim Oden	U.S. Geologic Survey
Jonathan Kennen	U.S. Geologic Survey
Dr. Bob Schuster	NJ Department of Environmental Protection
David Steinmann	U.S. Department of Agriculture, Natural Resources Conservation Service
Angela Andersen	Long Beach Township Marine Education Field Station
Dr. Peter Rowe	NJ Sea Grant Consortium
Michael J. Danko	NJ Sea Grant Consortium
Anthony M. Agliata	Ocean County Planning Department
Evangelista Vasilakis	Ocean County Planning Department
Michael DeLuca	Jacques Cousteau National Estuarine Research Reserve
Andrea Habeck	Jacques Cousteau National Estuarine Research Reserve
Elizabeth Butler	U.S. Environmental Protection Agency, Region 2
Barbara Spinweber	U.S. Environmental Protection Agency, Region 2
Cassandra Ponds	U.S. Environmental Protection Agency, Headquarters
Dr. Steve Yergeau	Rutgers Cooperative Extension of Ocean County
George Browne	Jersey Coast Anglers Association
Thomas Fote	Jersey Coast Anglers Association
Melissa Danko	Marine Trades Association of NJ
Kayci Clayton	Ocean County College
Mary Lancaster	Ocean County College
Christine Raabe	Ocean County Soil Conservation District
Becky Laboy	Ocean County Soil Conservation District
Mary Bavais	Ocean County Parks
Michael Gross	Georgian Court University
Dr. Jessica Lisa	Georgian Court University
John Protonentis	Ocean County Health Department
Peter Straub	Stockton University
Sandra Lazzaro	Ocean County Tourism
Joel Mott	Pinelands Commission
Amber Malm	Pinelands Commission
Tony McDonald, Esq.	Monmouth University, Urban Coast Institute
Dr. Thomas Herrington	Monmouth University, Urban Coast Institute
Meredith Comi	Monmouth University, Urban Coast Institute
Jaclyn Rhoads	Pinelands Alliance
Carlton Montgomery, Esq.	Pinelands Alliance
Dr. Heidi Yeh	Pinelands Alliance
Charles Caruso, Esq.	Pinelands Alliance
John Meiman	ReClam the Bay



Rick Bushnell
Bill Walsh
Eric Schradling
Dr. Kim McKenna
Dr. Shuting Lu
Rob Karl
Cindy Zipf
Dr. Swarna Muthukrishnan

ReClam the Bay
ReClam the Bay
U.S. Fish and Wildlife Service, NJ Field Office
Stockton University, Coastal Research Center
Kean University
Brick Township Municipal Utilities Authority
Clean Ocean Action
Clean Ocean Action

SCIENCE AND TECHNICAL ADVISORY COMMITTEE

Gregg Sakowicz, Chair
Dr. Thomas Grothues
Dr. Christine Thompson
Colleen Adams
Dr. Steven Yergeau
Dr. Douglas Zemeckis
Jessie Murray
Christine Wieben
Dr. Jonathan Kennen
John Protonentis
David Steinmann
Dr. Bob Schuster
Kim Cenno
Michael Auriemma
Dr. James Vasslides
Rob Karl
Gerald Wilders
Barbara Spinweber
Dr. Peter Rowe
Michael J. Danko
Dr. Joe Smith
Andrew McGowan
Evangelia Vasilakis
Jennifer Morganti
Robert Shertenlieb
Keith Marcoon
Dr. Jessica Lisa
Dr. Heidi Yeh
Charles Caruso, Esq.
John Meiman
Ed Pietrowicz
Bill Walsh
Rick Bushnell
Dr. Swarna Muthukrishnan
Christine Raabe
Kristin Adams
Dr. Shuting Liu
Dr. Jun Cheng
Dr. John Wnek
Dr. Thomas Herrington
Meredith Comi
William Shadel

Jacques Cousteau National Estuarine Research Reserve
Jacques Cousteau National Estuarine Research Reserve
Stockton University
Ocean County College
Rutgers University Cooperative Extension, Ocean County
Rutgers University Cooperative Extension, Ocean County
NOAA Fisheries
U.S. Geologic Survey
U.S. Geologic Survey
Ocean County Public Health Department
U.S. Department of Agriculture, Natural Resources Conservation Service
NJ Department of Environmental Protection
NJ Department of Environmental Protection
NJ Department of Environmental Protection, Marine Habitat and Shellfish
NOAA Habitat Division
Brick Township Municipal Utilities Authority
Brick Township Municipal Utilities Authority
U.S. Environmental Protection Agency, Region 2
NJ Sea Grant Consortium
NJ Sea Grant Consortium
U.S. Fish and Wildlife Service, Edwin B. Forsythe National Wildlife Refuge
Barnegat Bay Partnership
Ocean County Planning Department
Ocean County Planning Department
Ocean County Utilities Authority
Ocean County Utilities Authority
Georgian Court University
Pinelands Alliance
Pinelands Alliance
ReClam the Bay
ReClam the Bay
ReClam the Bay
ReClam the Bay
Clean Ocean Action
Ocean County Soil Conservation District
Ocean County Soil Conservation District
Kean University
Kean University
Ocean County Vocational and Technical School MATES
Monmouth University Urban Coast Institute
Monmouth University Urban Coast Institute
The Nature Conservancy





Although the information in this document has been funded wholly or in part by the United States Environmental Protection Agency pursuant to a grant agreement with Ocean County College, it has not gone through the Agency's publication review process and may not necessarily reflect the views of the Agency; therefore, no official endorsement should be inferred.