STATE OF NEW JERSEY

CLIMATE CHANGE RESILIENCE STRATEGY

2021

This work was make possible with financial assistance from the Coastal ZoneManagement Act of 1972, as amended, administered by the Officefor Coastal Management, National Oceanic and Atmospheric Administration (NOAA) through thte New Jersey Department of Environmental Protection, Coastal Management Program.

ACKNOWLEDGEMENTS

The *New Jersey Climate Change Resilience Strategy* would not have been possible without the help of the following State departments, agencies, and organizations:

Interagency Council on Climate Resilience:

- **Department of Agriculture**
- **Department of Banking and Insurance**
- **Department of Community Affairs (DCA)**
- **Department of Environmental Protection (DEP)**
- **Department of Health (DOH)**
- **Department of Human Services (DHS)**
- **Department of Law and Public Safety**
- **Department of State**
- **Department of Transportation (DOT)**
- **Department of Treasury**
- **Board of Public Utilities (BPU)**
- **Economic Development Authority (EDA)**
- **New Jersey Highlands Council**
- **New Jersey Infrastructure Bank (NJIB)**
- **New Jersey Transit**
- **New Jersey Turnpike Authority (NJTA)**
- **New Jersey Office of Emergency Management (NJOEM)**

Michael Baker INTERNATIONAL

Michael Baker International, Inc.
300 American Metro Boulevard
Suite 154, Hamilton, NJ 08619

Photo: Hoboken/Weehawken, NJ

April 22, 2021

Fellow New Jerseyans,

Climate change is the single greatest long-term threat currently facing humanity, and our state and economy are uniquely vulnerable to its devastating effects. The science of climate change is clear. As detailed in the *New Jersey Scientific Report on Climate Change* released by our administration last year, temperatures are increasing, sea levels are rising, and severe storms are becoming more frequent and intense. These risks are already manifesting across New Jersey and they will only worsen in the years to come, posing predictable and adverse impacts to our communities, economy, public health, and the daily lives of our residents.

Confronting climate change requires decisive and intentional action across all sectors and levels of government. To prepare New Jersey to meet this challenge, our administration has developed this first statewide *Climate Change Resilience Strategy*, an iterative planning tool to be continually updated pursuant to Executive Order No. 89 (Oct. 29, 2019). Intended to guide institutions in building programs and policies that promote climate resilience, the Strategy makes more than one hundred recommendations across six primary areas.

While broad in its reach, the *Strategy* is but a first step in a years-long effort to aid New Jersey communities and institutions in adapting to the realities of climate change. This inaugural edition could not and does not prescribe the detailed legislative, regulatory, and policy changes that must be developed through further public discourse. Rather, it establishes baseline considerations, suggests a prioritization of key public policy concerns, and presents a framework for continuous public engagement. Importantly, the *Strategy* acknowledges that climate change will not impact all New Jerseyans equally. The state's more vulnerable communities are already facing disproportionate climate risks and are likely to face greater adverse outcomes if equity and justice are not prominent and consistent features of the state's adaptation efforts. To that end, the *Strategy* places climate justice squarely at its center.

Finally, we must note that this *Strategy* and the actions that must follow would not be possible without the dedicated staff of the Department of Environmental Protection's Bureau of Climate Resilience Planning and the thoughtful collaboration of representatives from across the seventeen state agencies that comprise New Jersey's Interagency Council on Climate Resilience. Over the last eighteen months, and amidst a global pandemic that has only solidified our commitment to preparedness, these public servants assembled to develop this framework for ensuring New Jersey's resilience to climate change. Together with the emissions reductions proposed in the 2020 *Global Warming Response Act 80x50 Report* and the 2019 *Energy Master Plan*, the *Strategy* will further support our great state in responding to climate change through measures that protect our communities and environment, grow our economy, and lift all of our people.

Together, we will meet this critical moment.

Philip D. Murphy
Governor

Shawn M. LaTourette
Acting Commissioner of Environmental Protection

Jane E. Cohen
Chair, Interagency Council on Climate Resilience
Director, Governor's Office of Climate Action
and the Green Economy

David Rosenblatt, Chief Resilience Officer
Vice-Chair, Interagency Council on Climate Resilience
Assistant Commissioner for Climate & Flood Resilience
Department of Environmental Protection

STATE OF NEW JERSEY

CLIMATE CHANGE RESILIENCE STRATEGY

"Predicting rain doesn't count; building arks does."

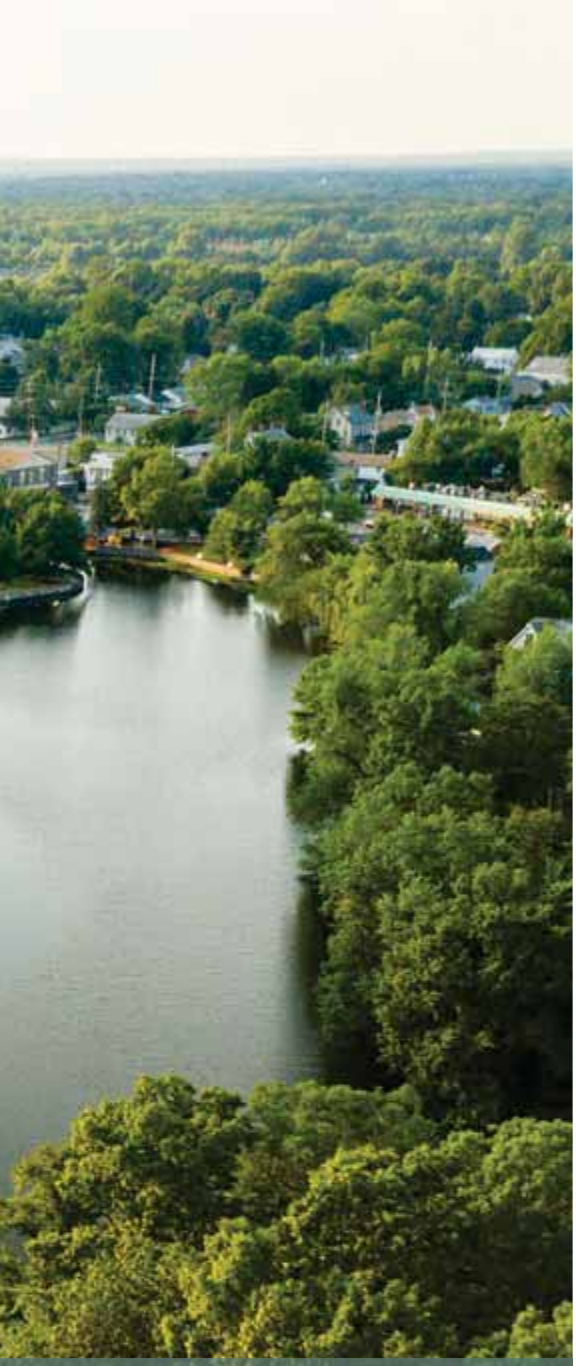
- Warren Buffet

Photo: Mullica River, NJ

EXECUTIVE SUMMARY

Hightstown, NJ

DRAFT



INTRODUCTION

Climate change is the most urgent, and complex long-term threat society faces. Climate change poses an immediate and severe threat to the environment, human health and welfare, security, and the economy—in New Jersey, across the United States, and around the world. Rising sea-levels, increasing temperatures, more frequent and intense storms, and chronic flooding are among the noticeable changes that communities already experience. Furthermore, these impacts compound other challenges, such as, infrastructure conditions, inequality, and public health. Unfortunately, climate impacts and their secondary effects will worsen in the years ahead, even with aggressive emissions reductions due to the greenhouse gases that will remain in the atmosphere. Current greenhouse gas mitigation initiatives are imperative to minimizing the long-term threats of a changing climate, but they are insufficient to protect New Jersey from the adverse impacts of climate that we are already experiences and that will worsen. Combating climate change requires both aggressive actions to curb emissions, while simultaneously building resilience into the natural and built environments.

Recognizing that enhancing New Jersey's resilience to climate change cannot wait and requires coordinated leadership, Governor Phil Murphy signed Executive Order 89 establishing the Interagency Council on Climate Resilience in October 2019. This Interagency Council brings together seventeen agencies with responsibilities for maintaining the physical, environmental, and economic health of New Jersey's precious resources and communities. The executive order also created the position of the Chief Resilience Officer for New Jersey and charged this position with delivering the state's first *Climate Change Resilience Strategy* and *Coastal Resilience Plan*, with support from the Interagency Council. Enhancing the resilience of New Jersey's communities, ecosystems, infrastructure, and economy requires an all-hands on deck approach to governing; the Interagency Council on Climate Resilience will lead this effort.

> *"Climate change is the single greatest long-term threat currently facing humanity and effectively combatting it will require a whole of government approach"*
> *– Governor Phil Murphy*

This inaugural *Resilience Strategy* outlines the broad policy framework under which the Interagency Council on Climate Resilience's work will occur. The scale of action needed to address climate impacts is unprecedented, and this *Resilience Strategy* is only the first step. Confronting climate change will require efficiency in the use of capital, maximizing co-benefits at every opportunity, and innovative solutions to ensure that New Jersey's communities, landscapes, and economy are designed for the future, and not the past. Climate change will permeate

Governor Phil Murphy (center) signs an executive order to establish a statewide Climate Change Resilience Strategy on October 29, 2019 (Edwin J. Torres/Governor's Office).

every sector and affect every individual, family, and community in some way. These impacts will not be universal and some populations, communities, and sectors are more vulnerable to the anticipated fluctuations in temperatures, precipitation, and the subsequent impacts.

For this reason, this document intentionally follows the release of the New Jersey's first *Scientific Report on Climate Change*. To identify how state agencies and others in New Jersey can improve their response to climate change, it is important to understand how climate change may affect different sectors, resources, and populations. The report, released in June 2020, summarizes 480 scientific research papers and studies to detail how climate change is and will continue to affect New Jersey. The report outlines how increases in temperature, shifts in precipitation, sea-level rise, and other climate change-related impacts threaten air quality, water quality, and the state's natural and built environments. This report is a critical advancement to understanding the wide-ranging effects climate change will have on the state and provides the scientific basis for the actions contained in this *Resilience Strategy*. Some key findings from this report are included on pages 5 - 7 of this document.

The *Scientific Report* provides the foundation for this *Resilience Strategy*, but it was only one of many previous initiatives used to develop actions. Many agencies have taken steps to improve resilience by reducing future flood damage to infrastructure, communities, and ecosystems, largely in response to major flood events in the past ten years. These efforts are represented throughout the strategy. Additionally, experts from state agencies, academic institutions, the private sector, and non-profit organizations have been researching and opining on strategies New Jersey can employ to respond to climate change for many years. The *Resilience Strategy* includes many recommendations identified through those reports, plans, and other projects considered parallel initiatives such as *New Jersey's Global Warming Response Act: 80 x 50 Report*, the *Energy Master Plan*, and the 2018 economic development plan, *The State of Innovation: Building a Stronger and Fairer New Jersey*. In addition, the Interagency Council looked across the country to find models for how other state governments are responding to climate change and integrated these best practices into future actions.

Through the research conducted, the Interagency Council has identified 125 broad actions across six core priority areas to enhance resilience across the state. Each chapter of this *Resilience Strategy* details one of the priority areas and the actions state agencies will take to build resilience to all climate impacts. The priority areas and key anticipated outcomes of the identified actions are highlighted in the following pages.

THE RESILIENCE STRATEGY AT A GLANCE

A VISION FOR CLIMATE RESILIENCE

New Jersey defines "climate resilience" as the ability of social and ecological systems to absorb and adapt to shocks and stresses resulting from a changing climate, while becoming better positioned to respond in the future. Resilience is not an end-state, but a dynamic state-of-being that will grow more difficult to attain as the climate continues to change. Resilience is perseverance with grace, strength in the face of adversity and hardship, resourcefulness to leverage what is available, and faith in the road that lies ahead. A resilient New Jersey is prepared for the future that climate change brings with recognition that there will be challenges, some overwhelming, but they will be met with scientific prowess, innovation, collaboration, and a commitment to justice. Furthermore, resilience efforts should support, and not undermine, the effort to slow climate change as described in the *80 x 50 Report*. These principles of building climate resilience thread through the actions in this *Resilience Strategy* and underscore the Interagency Council's commitment to building a stronger and fairer New Jersey while proactively confronting climate change.

"A resilient New Jersey is prepared for the future that climate change brings with recognition that there will be challenges, some overwhelming, but they will be met with scientific prowess, innovation, collaboration, and a commitment to justice."

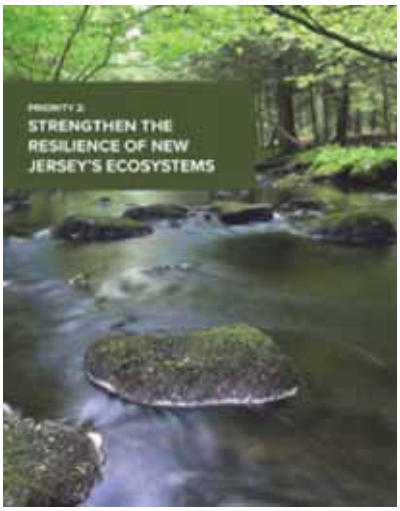
1 PRIORITY 1: BUILD RESILIENT AND HEALTHY COMMUNITIES

A resilient New Jersey starts with strong, vibrant, and healthy communities. Nearly 9 million people call New Jersey home, making it the densest and one of the most diverse states in the country. The landscapes from the highlands to the sandy beaches of the barrier islands are as diverse as their people, cultures, and history. Climate change will continue to place stress on these vibrant places and their residents. Fostering community resilience will require planning, innovation, decisive action, collaboration, and an unwavering commitment to sound, science-based decision-making.

Key Outcomes

- A statewide technical assistance program to support local climate resilience actions
- Increased integration of climate change into local, regional, and state planning
- Expanded support for workforce development and capacity-building across all levels of government
- Focused resources and policies to address inequities in underserved communities

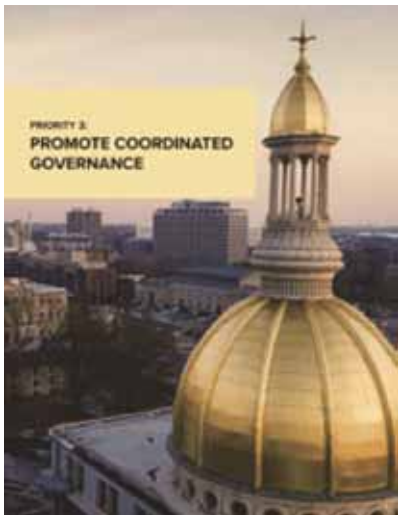
2 PRIORITY 2: STRENGTHEN THE RESILIENCE OF NEW JERSEY'S ECOSYSTEMS



New Jersey is rich with beautiful mountains, lakes, rivers, and beaches that are the delight of its residents and tourists alike. The farms, forests, bays, and other ecosystems in New Jersey are vital to the state's economy and identity as the Garden State. They also provide critical habitat to more than 3,700 wildlife species, from monarch butterflies to blue whales. With ecosystem services ranging from water filtration to flood attenuation to recreation, New Jersey residents rely on their natural environment for clean air and water regardless of where they live or work. These incalculable benefits afforded by the state's healthy ecosystems are at risk from the impacts of climate change. Protecting our natural systems, minimizing environmental threats, and restoring degraded areas are critical to protecting the health and vitality of all natural resources in the state, as well as the benefits they provide to residents.

Key Outcomes

- Healthier ecosystems that are more resilient to climate change impacts
- Enhancement of ecosystem services to benefit overall state resilience, including water storage and filtration, flood attenuation, carbon sequestration, and urban heat mitigation
- Natural resources, agriculture, and public lands better positioned to adapt to environmental changes



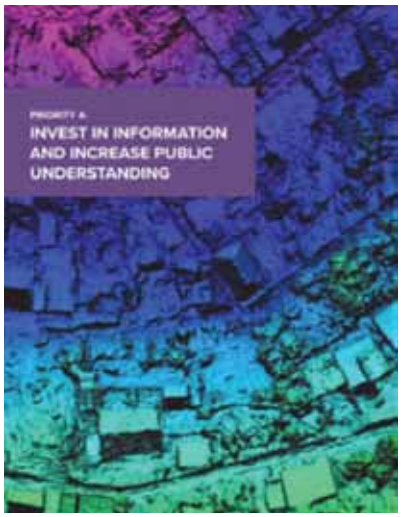
PRIORITY 3: PROMOTE COORDINATED GOVERNANCE

3

Climate change impacts will affect every aspect of state and local government, just as they will every sector of New Jersey's economy, and every resident. State agencies need to consider climate change as part of business as usual for everything the government does. By viewing the operations of government through a climate resilience lens, New Jersey will be able to confront the coming impacts in a proactive manner. The Interagency Council on Climate Resilience brings these perspectives together to create a coordinated approach to addressing climate resilience.

Key Outcomes

- Efficient, proactive, communicative governance of statewide climate resilience policy through the Interagency Council on Climate Resilience
- High level engagement and accountability across state agencies
- Inclusion of local government and community leaders and their expertise in state resilience decisions



PRIORITY 4: INVEST IN INFORMATION AND INCREASE PUBLIC UNDERSTANDING

4

Climate change is the defining issue of our time. As a threat multiplier it will permeate every sector, resource, and community with wide-reaching implications. Increasing resilience to these impacts requires preparedness, and awareness is a key part of being prepared. It is critical that the state is using the best available information for its own decision-making and proactively sharing that information with residents, businesses, and other stakeholders.

Key Outcomes

- A multi-faceted public education and risk communication campaign
- Improved data and methods for understanding climate resilience
- Increased engagement from the public, business community, and all levels of government

5 PRIORITY 5: PROMOTE CLIMATE-INFORMED INVESTMENTS AND INNOVATIVE FINANCING

The scale of action needed to address climate impacts is unprecedented, requiring extraordinary efficiency in capital deployment and the opportunity to maximize co-benefits with every dollar. Both public and private funds will be essential to funding resilience actions throughout the state. Given the significant risks that climate change poses for current investments of public funds, climate risk assessment and avoidance becomes vital. It is important that the State prioritizes investment of public dollars into activities that serve the long-term economic needs and boost the resilience of communities, especially those that are least able to respond.

Key Outcomes

- Integrate climate considerations and fiscal risk from climate change impacts into funding criteria
- Prioritization of socially vulnerable populations in funding decisions
- Expanded use of private capital and innovative financing mechanisms to fund resilience

6 PRIORITY 6: COASTAL RESILIENCE PLAN

The coastal areas of New Jersey provide infinite value as places of residence, tourist destinations, cultural and historic assets, ecological resources, and economic drivers within the state. While climate change will impact every area in the state, nowhere are the challenges more acute than the diverse communities of the coastal zone. Responding to the threats of sea-level rise, changes in coastal storms, and other climate impacts will inevitably change the look and feel of communities up and down the coast. Transforming state coastal management, increasing nature-based resilience measures, and encouraging proactive planning for sea-level rise and increased storm risk are the central goals of the state's first *Coastal Resilience Plan*.

Key Outcomes

- An expanded tidal wetland monitoring program
- Resilience incorporated into design of new development and redevelopment projects
- Prioritization of state funding for coastal resilience projects to protect major population and economic centers, concentrations of critical infrastructure, and socially vulnerable populations
- More private property owners adapting to climate change
- Assessment of relocation policy opportunities and obstacles

ENGAGEMENT AND OUTREACH

In developing the plan, members of the Interagency Council gathered input from stakeholders through various events, including a summit on Coastal Resilience, several workshops, and smaller engagements with local officials, resilience professionals, and other experts. In spring of 2020, several scheduled outreach events that had been planned were cancelled due to COVID-19 transmission concerns. In lieu of the in-person events a webinar was held in April and was attended by 350 participants. In addition to the opportunity to provide comment during the webinar, there was also an electronic survey posted. The results are available on the Interagency Council's website.

Responses to:"What action do you think the State needs to take in the next 5 years to increase the overall resilience of New Jersey to Climate Change?"

2020 CLIMATE RESILIENCE SURVEY RESULTS

Top Six Concerns regarding climate change effects as selected by participants:

1. Increasing Precipitation/Storms
2. Sea-level Rise
3. Decreased Water Quality
4. Extreme Temperatures
5. Ocean Acidification
6. Decreased Air Quality

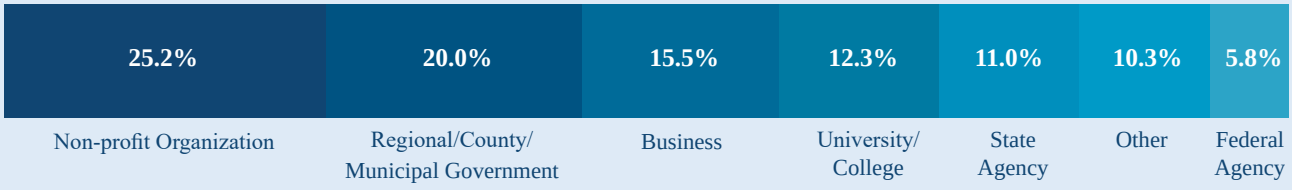
Climate Resilience Actions favored by participants to be implemented by the state:

1. Incentivize green infrastructure/nature-based solutions
2. Preserve natural lands
3. Regulate at risk buildings/development
4. Support vulnerable populations
5. Pilot innovative solutions

Coastal Resilience Strategies favored by participants to be implemented by the state:

1. Marsh restoration and migration
2. Living shorelines
3. Buyouts or managed retreat
4. Infrastructure projects
5. Beach and dune nourishment

Types of Organizations that participated:



CLIMATE JUSTICE

Although all New Jersey residents are affected by climate change, the state's most vulnerable communities stand to bear a disproportionate burden of adverse climate change impacts. Some populations are more adversely affected by climate change due to pre-existing factors like age or ability; and for some populations, unequal impacts are also a result of historic and systematic inequities. Many socially vulnerable populations, environmental justice (EJ) communities, and other Black, indigenous, and people of color (BIPOC) communities already experience socioeconomic and health inequities that exacerbate the increasing risks from climate change and make it more difficult to adapt to changing climate conditions. For example, for some individuals, factors like poverty, job insecurity, or special needs like autism, can make it more difficult to relocate during or after a storm. Others may face greater health risks from heat waves or lower air quality because of age, race, or pre-existing health conditions, such as asthma, or where they live. As social vulnerability inherently poses challenges to resilience and adaptation, this strategy aims to respond to climate threats and foster community resilience in an equitable and inclusive manner to prevent worsening existing inequality.

Socially vulnerable populations and underserved populations are prioritized in this strategy. The Centers for Disease Control and Prevention (CDC) defines social vulnerability as a "community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills."[i] The State considers the following characteristics as factors of social vulnerability: socioeconomic status, age, gender, race and ethnicity, English language proficiency, and disability. Here, underserved populations refer to any socially vulnerable, environmental justice, or other low-income and minority populations that have experienced historic under or disinvestment and are disproportionately burdened by or less able to prevent, respond, and recover from adverse environmental impacts.

Climate change creates new risks and is also a threat multiplier that compounds existing vulnerabilities and inequities. Socially vulnerable populations and other populations of concern often face both climate and non-climate related stressors that contribute to underlying community inequities. These stressors might include unequal access to health and economic resources, limited social cohesion, high crime or violence, or disproportionate exposure to environmental hazards. Since environmental, socioeconomic and health inequities are inextricably connected, climate change's devastating impacts on the physical environment, can in, turn create other negative impacts for socially vulnerable populations. By way of example, a person of low income who works outdoors could experience increased economic vulnerability as heat waves become more frequent and too hot to work, resulting in lost wages. For socially vulnerable populations, underlying societal inequities and challenges create the biggest hurdles to achieving resilience, and state agencies must consider and evaluate these issues as they create more opportunities for resilience.

Research also points to the disproportionate impact that climate change especially has on BIPOC communities in the United States.[ii] This is often due to historic discriminatory housing, environmental and investment policies, and exclusion from planning processes, among other factors. As a result, BIPOC communities have been subjected to living in segregated neighborhoods with more pollution, older infrastructure, and greater exposure to climate hazards, as well as lower income status, less economic mobility, and less access to quality and affordable healthcare. These pre-existing conditions make it more difficult for some BIPOC communities to adapt to climate change, and in fact can be exacerbated

by climate change impacts. The COVID-19 pandemic has recently laid bare that public policies have created conditions for poverty, economic instability, and pollution in and around BIPOC communities that elevate their risk of, and exposure to, deadly threats.

Additionally, characteristics of social vulnerability and existing inequities can affect adaptation options available to a community. For example, building elevations, which are a popular way to minimize flood damage from storms, are expensive and make it difficult for individuals who cannot manage stairs easily. A strategy to create a resilient New Jersey requires addressing the needs and challenges of *all* New Jerseyans.

New Jersey's approach to enhancing equity through climate resilience is three-fold. First, ensure climate change and resilience planning includes and is responsive to the entire community. State resilience planning efforts should be transparent, accessible, and responsive. Second, direct resources to build capacity in lower-resourced communities and foster local planning and resilience efforts driven by community leaders. Third, monitor resource distribution and outcomes to ensure that the state sees appropriate reductions in risk and measurable increases in resilience within all communities across the state. Across all six priorities in this strategy, state agencies are committed to improving resilience for those communities that face the steepest challenges in addressing the risks of climate change.

Executive Order 23 will help curb pollution and cumulative and secondary impacts for the approximately 4.5 million individuals living in areas classified as "overburdened."

Environmental Justice and Climate Change

In 2018, Governor Murphy issued Executive Order 23, which recognizes the historic and ongoing disproportionate exposure to various environmental burdens faced by many of New Jersey's low-income communities and BIPOC communities. The order directs the executive branch to ensure that the principles of environmental justice (EJ) are at the core of state policies and programs. To guide State decisions and the integration of EJ into executive agencies' core functions, the Department of Environmental Protection issued "Furthering the Promise: A Guidance Document for Advancing Environmental Justice Across State Government." The document provides a path forward for agencies to apply principles for furthering the promise of EJ in New Jersey, as identified by impacted communities and decades of local, state, and federal experience.

In 2020, the state legislature strengthened the state's commitment to addressing environmental justice through the passage of a law mandating the Department of Environmental Protection evaluate the environmental and public health impacts of certain facilities on overburdened communities when reviewing certain permit applications. Signed by Governor Murphy in September 2020, this landmark legislation will help curb pollution and cumulative and secondary impacts for the approximately 4.5 million individuals living in areas classified as "overburdened" by the legislation, and around the state.

[i] Centers for Disease Control and Prevention. 2015. Planning for an Emergency: Strategies for Identifying and Engaging At-Risk Groups. A guidance document for Emergency Managers: First edition. Atlanta, GA. https://svi.cdc.gov/Documents/Publications/SVI_Community_Materials/atriskguidance.pdf

[ii] Steichenv L., J. Patterson, and K. Taylor. 2018. In the Eye of the Storm: A people's guide to transforming crisis & advancing equity in the disaster continuum. National Association for the Advancement of Colored People. Baltimore, MD. https://live-naacp-site.pantheonsite.io/wp-content/uploads/2018/09/NAACP_InTheEyeOfTheStorm.pdf

CLIMATE CHANGE EFFECTS - WHAT WILL HAPPEN IN NEW JERSEY?

Rising Temperatures

New Jersey is warming faster than the rest of the Northeast region and the world.

Heatwaves are expected to impact larger areas, with more frequency and longer duration by 2050.

Increasing Percipitation

Annual precipitation in New Jersey is expected to increase by 4% to 11% by 2050.

The intensity and frequency of precipitation events is anticipated to increase due to climate change.

Sea -Level Rise

Sea-levels are increasing at a greater rate in New Jersey than other parts of the world.

By 2050, there is a 50% chance that sea-level rise will meet or exceed 1.4 feet and a 17% chance it will exceed 2.1 feet. Those levels increase to 3.3 and 5.1feet by the end of the century (under a moderate emission scenario).

Ocean Accidification

Since the industrial age, ocean pH levels have declined and the ocean is now 30% more acidic.

If carbon dioxide emissions continue at current rates, ocean pH levels are expected to fall, creating an ocean that is more acidic than has been seen for the past 20 million years.

Source: New Jersey Department of Environmental Protection. 2020. New Jersey Scientific Report on Climate Change, Version 1.0. (Eds. R. Hill, M.M. Rutkowski, L.A. Lester, H. Genievich, N.A.Procopio). Trenton, NJ. 184 pp.

CLIMATE CHANGE EFFECTS - WHAT WILL HAPPEN IN NEW JERSEY?

Decreased Water Quality

Surface and groundwater quality will be impaired as increased nutrients and contaminants enter waters due to runoff from more intense rain events.

Freshwater intakes and aquifer recharge areas may be threatened if sea-level rise pushes the salt front further upriver.

Extreme Weather

Tropical storms have the potential to increase in intensity due to the warmer atmosphere and warmer oceans that will occur with climate change.

Over the last 50 years, in New Jersey, storms that resulted in extreme rain increased by 71% which is a faster rate than anywhere else in the United States.

Drought

Droughts may occur more frequently due to the expected changes in precipitation patterns.

It is anticipated that droughts lasting three to six months and longer may slightly increase in frequency in the Northeastern United States under a low emissions scenario and will significantly increase under a high emissions scenario.

Decreased Air Quality

Despite on-going efforts to reduce ground-level ozone precursor emissions, New Jersey's air quality will be impacted due to changes in meteorological conditions, often referred to as the ozone-climate penalty which is "the deterioration of air quality due to a warming climate."

The Resilience Strategy intentionally follows the release of the New Jersey's first Scientific Report on Climate Change. The report, released in June 2020, summarizes 480 scientific research papers and studies to detail how climate change is and will continue to affect New Jersey.

CLIMATE CHANGE IMPACTS - HOW WILL NEW JERSEY BE AFFECTED?

Socially Vulnerable Populations

- Young children, elderly, socially or linguistically isolated, economically disadvantaged, and those with preexisting health conditions will be more at risk to health impacts from the combination of heat stress and poor urban air quality.

Infrastructure

- Aging public water supply infrastructure and demands are vulnerable to the consequences of climate change.
- Existing treatment infrastructure in New Jersey is not designed to treat elevated salt levels, and drinking water standards do not exist for the primary components of saltwater.

Health and Wellbeing

- The effects of climate change are likely to contribute to an increase in air pollution, lead to increased respiratory, and cardiovascular health problems.
- Urban populations are particularly vulnerable as climate models predict an increase in the number of days per year with temperatures affecting human health due to heat stress.

CLIMATE CHANGE IMPACTS - HOW WILL NEW JERSEY BE AFFECTED?

Ecosystems and Wildlife

- Climate change is likely to facilitate expansion of invasive plant species.
- 29% of New Jersey's bird species are vulnerable to climate change.

Coastal Communities

- "Sunny day flooding" will occur more often across the entire coastal area of New Jersey due to sea-level rise.
- Coastal areas are particularly vulnerable to flooding from storm surge and increased intensity of coastal storms.

Agriculture and Food Supply

- The productivity of crops and livestock are expected to change due to the climate-induced changes in temperature and precipitation patterns.

Oceans and Marine Life

- Ocean acidification not only threatens the health of the oceans, but also the economic value that people and industries depend on.

PRIORITY 1:

BUILD RESILIENT AND HEALTHY COMMUNITIES

INTRODUCTION

Climate change is a global challenge, but the impacts are experienced locally. Changes in precipitation, extreme temperatures, sea-level rise, and species shifts place stress on infrastructure, natural resources, and social and economic systems. These same impacts will directly affect public health and healthcare systems. How towns, cities, and counties prepare and respond to these stresses now will define New Jersey's resilience in the future. Decisions about zoning, redevelopment, housing, open space, and other investment decisions made by local and regional governments will alter the impacts of climate change on surrounding communities. Integrating climate change into these decisions and all planning efforts is imperative to ensure that investments made today are designed to withstand the conditions of tomorrow.

Therefore, it is imperative that state agencies prioritize resources to support community resilience activities. Community resilience refers to the dynamic and adaptive ability of a community to use available resources to withstand, respond to, and recover from adverse situations. Measurements and evaluation of community resilience should include considerations for physical, social, institutional, economic, and ecological dimensions of the community.[1] Addressing community resilience requires incorporating considerations for public health and equity. Ignoring these fundamental aspects of community well-being can exacerbate the challenges a community faces in mitigating the impacts of climate change-related events.[2] Increasing resilience is accomplished through a combination of reducing exposure to hazards, managing existing vulnerabilities, and increasing a community's capacity to efficiently respond and recover after an event.

When communities and the state are planning these resilience activities, the focus should be on "bouncing forward," rather than "bouncing back." Too often in recovering from a crisis, there is pressure to "return to normal," which misses key opportunities to maximize co-benefits through transformative recovery activities. Recovery and resilience activities should enhance the community's ability to respond better and more efficiently to adverse situations, not simply return the community to its pre-event baseline. It should be noted though, existing inequities place some communities more at-risk than others so the goal of "bouncing forward" is more challenging for some communities. To see equitable improvements across the state, agencies should be prepared to prioritize resources based on need and historic injustices.

STRATEGIES:

- **1.1 Integrate Resilience into Local and Regional Planning**
- **1.2 Increase Technical Assistance Programs to Address Community Resilience**
- **1.3 Modify Regulatory Programs to Address Climate Change Impacts and Encourage Adaptation Over Time**
- **1.4 Decrease Vulnerability of Existing Infrastructure and Development**
- **1.5 Incentivize Sustainable Growth and Redevelopment that Incorporates Resilience, and Relocation to Safer Places**
- **1.6 Integrate Public Health into Community Resilience Planning and Activities**

STRATEGY 1.1:
Integrate Resilience into Local and Regional Planning

ACTIONS

1.1.1 Integrate climate change into state, county, and regional planning documents and initiatives to help guide local actions

1.1.2 Promote local resilience and plan integration through state planning criteria

1.1.3 Integrate climate change into multi-jurisdictional multi-hazard mitigation planning

1.1.4 Provide clear actionable guidance on integrating climate change into local planning

1.1.5 Expand grant funding to support the integration of climate resilience into local and regional planning efforts

1.1.6 Support and incentivize inclusive, equitable, and transparent planning processes

NJ FRAMES Planning Outreach, Red Bank, NJ

Planning, by default, is a forward-looking practice. How should a community look, feel, and move in the future? Where will people work, live, and play? Where will new infrastructure, housing, and schools be located to support growth? Planning helps to shape the built environment by answering these questions through community engagement and visioning. Once the community agrees to a vision, the planning process identifies the policies and projects to support that ideal future. Resilience planning follows the same principles but introduces climate change as a central variable for consideration. How should a community look, feel, and move, considering sea-level rise and temperature increases? Given the amount of existing planning initiatives at state, county, and local levels within New Jersey, and given the widespread impacts New Jersey is already seeing from climate change, it is important that every planning process is a "resilience planning" process.

As a first step, state agencies are updating their own state-level plans, where such authority permits, to include climate change. The *2019 State Hazard Mitigation Plan* details anticipated impacts of climate change on New Jersey's most significant natural hazards, including flooding, erosion, and extreme temperatures. The Department of Environmental Protection (DEP) has included climate change in its *2020 State Forest Action Plan*. DEP is also working to address climate change in the *NJ Water Supply Plan,* which will look at climate impacts to water supply and infrastructure. These impacts include salinization from sea-level rise, drought, and impacts to water quality. The Department of Transportation (DOT) has identified extreme weather associated with climate change as one of the highest risks in achieving the goals of the *Transportation Asset Management Plan* completed in 2019. DOT is committed to including climate change considerations and resilience as one of the considerations

in the future updates of its *Long-Range Transportation Plan*. Updates to these state planning efforts allow for prioritization and alignment of state policy efforts.

State plans are only one type of planning that guides investment and development across the state. In January 2020, Governor Murphy signed legislation that modifies the Municipal Land Use Law to require that updates to land use elements of local master plans include a climate change-related hazard vulnerability assessment. This amendment has the potential to accelerate local climate resilience actions by incorporating climate science into local planning efforts. It also aligns with newly adopted guidance from the Office of Planning Advocacy (OPA) that require local municipalities develop a local resilience strategy to meet Plan Endorsement criteria. Furthermore, the Office of Emergency Management (OEM) is updating its own guidance for local hazard mitigation planning to incorporate inclusion of climate change. Collectively, these efforts will encourage more local resilience planning and strategy development across the state.

New Jersey has 565 municipalities with diverse governance structures to manage and respond to the variety of needs specific to each locality. These municipalities cover a diverse range of environments (coastal, riverine, agricultural, suburban, rural, urban, etc.) and are home to unique resident populations. It is important to recognize that community resilience looks different for each neighborhood, town, and city, based on their own exposure, vulnerabilities, resources, and capacity to respond. The DEP, in close coordination with other members of the Interagency Council, is working to develop guidance to help advance local action to respond and adapt to climate change, through inclusive, equitable, and transparent planning processes. Using Post-Sandy funds, the Department of Community Affairs allocated over 19 million dollars to local resilience planning efforts. The DEP and Economic Development Authority (EDA) have upcoming funding to support local planning efforts and state agencies continue to seek opportunities to expand programs and provide additional funding in the future.

Resilient NJ

The Resilient NJ program, managed by DEP, provides funding and technical assistance for local and regional climate resilience planning. The current round of funding, provided by the US Department of Housing and Urban Development through the National Disaster Resilience Competition, was awarded to develop four long-term regional action plans across 24 municipalities in the coastal zone. Information on these projects is available at Resilient.nj.gov.

The program assists municipalities with the following:

- Provide local resilience guidance to communities
- Assess current and future flood risk through 2070 from rainfall, storm-surge, and tidal flooding
- Develop innovative and implementable solutions that increase climate resilience in both the short-and long-term
- Reach underserved populations, ensure representation and participation from socially vulnerable populations, and co-development of equitable solutions
- Identify projects that enhance the value and integrity of ecological, recreational, and economic resources
- Put these plans into action using set-asid e project funds

The Resilient NJ: Local Planning for Climate Change toolkit, is a resource for communities in New Jersey to proactively plan for the changing climate and build resilience into their local governance. Communities that utilize the guidance can meet their obligations under the Municipal Land Use Law requirements, state Hazard Mitigation Plan requirements, and Plan Endorsement requirements. The resources within the local resilience guidance will also help communities integrate equity considerations into climate resilience planning. This toolkit will be available in early summer 2021.

STRATEGY 1.2: Increase Technical Assistance Programs to Address Community Resilience

ACTIONS

1.2.1 Develop a statewide resilience technical assistance program

1.2.2 Strengthen state oversight and requirements for local floodplain managers

1.2.3 Prioritize building capacity in underserved communities

Dover, NJ

During the development of this strategy, stakeholders cited support for local resilience efforts as a critical need in confronting climate change. In response to a survey, stakeholders ranked guidance and funding as two key investments the state could make to support local resilience efforts. This idea is not necessarily new; building local capacity is a long-standing objective of several ongoing programs across the Interagency Council. Programs such as Watershed Ambassadors and the Community Collaborative Initiative at DEP, and the Local Assistance Bureau at the Department of Community Affairs (DCA), the Department of Transportation's Local Aid Resource Center, supplement local resources with on-the-ground expertise.

The DEP Bureau of Flood Engineering provides floodplain management assistance to local communities throughout the state through their National Flood Insurance Program (NFIP) Community Assistance Program. The program reaches out to each municipality participating in the NFIP through a five-year cycle of Community Assistance Visits, Community Assistance Contacts, technical assistance, and workshops and other training. Maintaining an understanding of the requirements of the NFIP in each of these municipalities presents a considerable challenge, particularly when there is a high turnover rate among local floodplain administrators.[3]

2020 Climate Resilience Survey Results

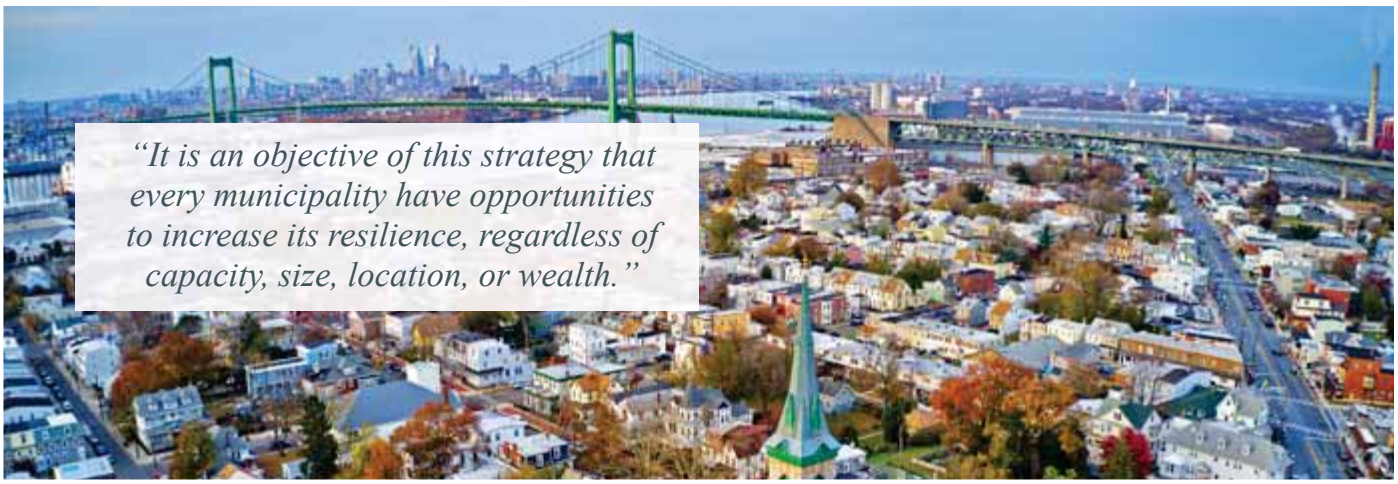
Participants Identified the Top Strategies for the State to Best Support Municipal Climate Resilience Actions:

1. Funding/Financing
2. Guidance Development
3. Direct Assistance

State agencies have expanded support for local resilience efforts in recent years. The DEP established a new Bureau of Climate Resilience Planning, which is charged with providing technical assistance to support local community resilience planning efforts. Additionally, the OPA added capacity to support municipalities seeking Plan Endorsement. There is also been considerable effort by academic institutions, nonprofits, and private entities to provide expertise and assistance in these efforts. The Interagency Council will continue to work toward the development of a statewide technical assistance program focused on climate resilience, with a focus on leveraging federal and non-governmental partners to support this effort.

In addition to providing direct technical assistance, the state oversees technical professionals who advise municipalities through various licensing programs. But this oversight does not extend to floodplain management. Every municipality that participates in the NFIP designates a floodplain manager, usually through their flood management ordinance, but the state has no authority to require municipalities identify these individuals. Furthermore, unlike local planners and engineers, there are no requirements that floodplain managers have any special knowledge, skills, or understanding to execute the function of the position. As the climate continues to change, the need for expertise at the local level will only grow. This strategy recommends ensuring the state can maintain proper oversight of local floodplain management to ensure public safety and well-being now and into the future.

It is an objective of this strategy that *every* municipality have opportunities to increase its resilience, regardless of capacity, size, location, or wealth. This will only be achievable with increased capacity at the local level developed through state government leadership, guidance, and support. Achieving this objective also requires prioritizing resources for those who need them most, meaning municipalities that have been traditionally underserved and face vulnerability from the impacts of climate change. While all municipalities face impacts from climate change, some towns are at an increased risk and have less resources to address their vulnerabilities. Prioritization of technical assistance resources for these communities is necessary to ensure an equitable increase in resilience across all municipalities in the state, regardless of size and capacity.



City of Gloucester, NJ

STRATEGY 1.3: Modify Regulatory Programs to Address Climate Change Impacts and Encourage Adaptation Over Time

ACTIONS

1.3.1 Assess existing rules and policies and future reforms that support climate change resilience

1.3.2 Work with the NJ legislature to evaluate state and local statutory authorities to address resilience and expand where needed

1.3.3 Promote risk disclosure for property owners in current and future hazard areas

1.3.4 Increase local compliance with existing regulations, policies, and programs that reduce risk from flooding and other climate change effects

1.3.5 Track state permits, waivers, and compliance to monitor policy effectiveness

1.3.6 Encourage state and local flood policies to exceed National Flood Insurance Program minimum standards

New Development in Jersey City, NJ

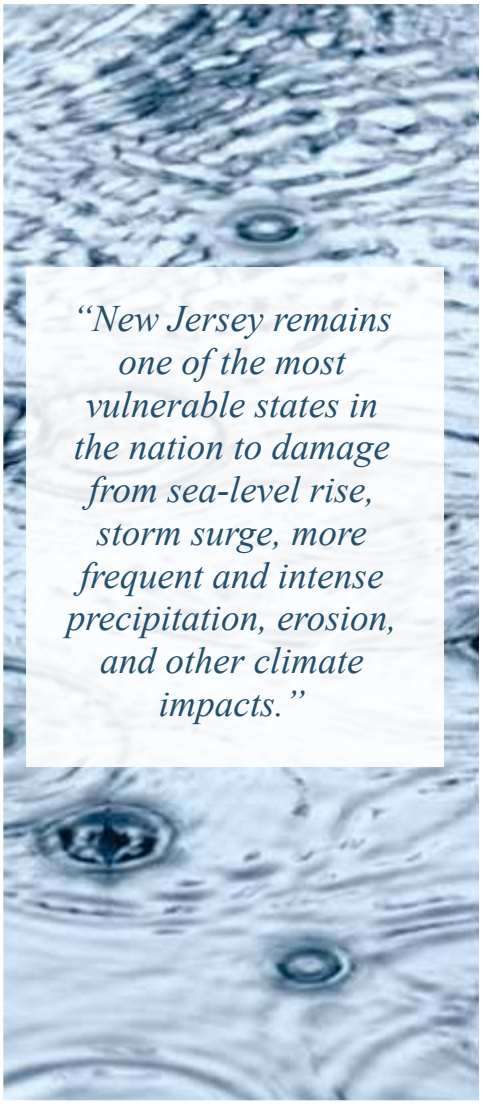
New Jersey has robust state-wide regulatory programs that govern the siting, design, and construction of buildings and infrastructure. These laws, created by decades of legislative action, grant authority to state agencies to address various threats to public safety, welfare, and environmental resources. Several of these statutes, such as the Wetlands Act of 1970, the Coastal Area Facility Review Act (CAFRA), the Flood Hazard Area (FHA) Control Act, and the State Uniform Construction Code (UCC) Act regulate activities that will be directly impacted by climate change. The original legislation was not developed with an understanding of climate change, and therefore the existing rules and regulations are often insufficient to address the state's resilience needs. As a result, and in combination with decades of dense development patterns, historical manipulation of rivers and floodplains, and natural topography, New Jersey remains one of the most vulnerable states in the nation to damage from sea-level rise, storm surge, more frequent and intense precipitation, erosion, and other climate impacts.

In 2020, Governor Murphy signed Executive Order 100 directing DEP to make sweeping regulatory reforms, branded as Protecting Against Climate Threats (PACT), to reduce emissions and adapt to climate change. The PACT rulemaking effort the first in the state to actively modify existing floodplain and wetland regulations to incorporate climate change. The Executive Order mandated that DEP update its FHA Rules, Stormwater Management Rules, and Coastal Rules to reflect the best available science on climate change. DEP intends to release the proposed rules by mid-2021. NJ PACT is the first rulemaking effort in the state to integrate climate

change into regulations, but it cannot be the last. There are other rules, policies, or existing statutes that may need to be revised to respond to the harmful impacts of climate change. For example, the authority for the state's oversight of the Uniform Construction Code does not allow for consideration of future conditions. The current building code was adopted in 2019 and is based on the International Building Code/2018. The DCA has identified future updates that incorporate climate resilience as a necessary next step but does not have the authority to modify it as often or in ways necessary to respond to climate change. The statute that grants DCA its authority for this function limits the agency to adopting sections from the International Construction Code Council. As the ICC updates its codes and subcodes to address climate change, DCA will review modifications to adopt into the state code. Alternatively, the legislature could expand the authority to allow DCA more flexibility in modifying the code. This recommendation is shared by the state's recent 80x50 greenhouse gas emissions reduction plan released in 2020.

Modifying regulatory programs is not limited to the permitting activities of the state. Currently, prospective property owners have limited information to determine the level of risk and insurance premium costs necessary to sustainably live in a flood zone, particularly in areas subject to sea-level rise. In New Jersey, there are no statutory or regulatory requirements for real estate disclosures from the seller. While the state courts have ruled that sellers must provide knowledge of material defects, the requirements related to current or future hazards are unclear. In contrast, many states have disclosure forms that provide critical information to the buyer, including flooding history and insurance obligations. Currently, Louisiana, Mississippi, and Oklahoma have the strongest real estate disclosure laws in the country.[4] Disclosure requirements might include improving access to elevation certificates, substantial damage determination letters, and/or requiring flood zone disclosure and documentation of past flooding. These actions would allow potential buyers to fully evaluate monthly mortgage costs and weigh the disaster recovery costs prior to making an offer on a property. Enacting disclosure laws would further resilience by encouraging the seller take mitigation actions before the sale or informing the buyer of the costs to bring the house into regulatory compliance.

Other Interagency Council actions will work to improve compliance with existing regulations, as well as track regulatory programs to monitor effectiveness, and continue to encourage municipalities to exceed federal minimum standards provided by the NFIP.



"New Jersey remains one of the most vulnerable states in the nation to damage from sea-level rise, storm surge, more frequent and intense precipitation, erosion, and other climate impacts."

New Jersey's Global Warming Response Act 80x50 Report recommends that the legislature expand DCA's authority allowing more flexibility in modifying codes and subcodes to address climate change.

STRATEGY 1.4: Decrease Vulnerability of Existing Infrastructure and Development

ACTIONS

1.4.1 Prioritize reducing future impacts to critical buildings and critical infrastructure systems

1.4.2 Expand building retrofitting programs and support for both flood and non-flood hazards

1.4.3 Encourage increased insurance coverage in current and future hazard areas

1.4.4 Provide guidance and design guidelines for building resilience into existing buildings

George Washington Bridge, Fort Lee, NJ

Just as it is important to ensure new development and redevelopment is designed to withstand the conditions of tomorrow, the state must also retrofit existing infrastructure and development to manage climate impacts. Climate change threatens existing infrastructure systems in several ways. For example, increased heat waves may drive buckling of pavement and misalignment of rail lines. Recurrent coastal flooding can overwhelm stormwater drainage systems at high tide, requires frequent road closures, and results in general deterioration and corrosion of infrastructure not designed to withstand frequent inundation or saltwater exposure.[5] Additionally, the February 2021 winter storm in Texas demonstrated some potential impacts of extreme temperatures on energy infrastructure. Damage and service disruptions of public utilities, transportation networks, emergency response, medical care and government services resulting from natural hazard events can lead to significant, long term adverse socioeconomic impacts.

In addition to the exposure of these systems, one significant threat to infrastructure from climate change is the increasing cost of maintaining infrastructure approaching or beyond its design life—maintenance that is already chronically underfunded. Without considering climate impacts, the American Society of Civil Engineers estimates that there is already a $1.2 trillion gap nationally in transportation infrastructure

needs. Furthermore, infrastructure systems are frequent interdependent on other sectors, such as the connection between transportation networks and the energy and telecommunications sectors. Each component of the system have their own climate-related vulnerabilities and existing costs.[6] This already fraught picture is further complicated by the diverse ownership interests across these assets. The State only owns approximately 9 percent of the roadways, compared to a nationwide average of 20 percent; the vast majority of roadway miles (27,921) in New Jersey are owned by municipalities.[7] The rail system is a shared asset among Amtrak, NJ TRANSIT, the Department of Transportation (DOT), 18 freight railroads, and the Southeast Pennsylvania Transit Agency (SEPTA). These are only examples of the vulnerabilities facing existing infrastructure and development. Members of the Interagency Council will prioritize reducing climate impacts to critical buildings and critical infrastructure systems through regional coordination and capital, grant, and regulatory programs, to the extent allowed by current authority.

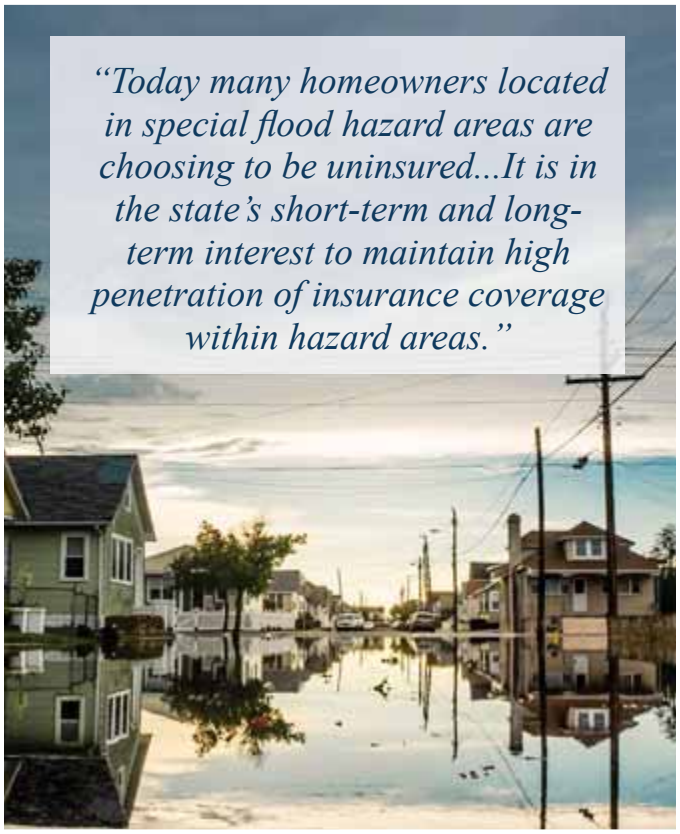
While addressing critical infrastructure resilience needs to be a priority, New Jersey's building stock will also require significant investment to respond to climate impacts. Recent studies highlight the risks to existing buildings across the state from both coastal and inland flooding. Climate change is anticipated to increase the intensity and frequency of flood events, increasing the overall number of properties vulnerable to damage, and the overall financial damage to those properties already at-risk.

Of the buildings at-risk for flooding, it is unknown how many have already been elevated above anticipated flood levels. The OEM is working to improve the state's data on building elevation and flood exposure through multiple ongoing efforts. Since Sandy there has been considerable effort to reduce flood risk by raising flood-prone homes. The DCA and the OEM continue to raise buildings above current flood elevations. Building elevations will continue to be a fundamental strategy in the state to reduce the cost of future floods to individuals, the state, and federal taxpayers.

In addition to elevations or other mitigation strategies, an important practice to reduce the vulnerability of existing structures in hazard areas is adequate insurance coverage. Today many homeowners located in special flood hazard areas are choosing to be uninsured.[8] Furthermore, research shows that immediately following a serious flood event or a year with high flood damage insurance policies will increase, but that this bump disappears approximately three years after the event.[9] This trend has implications for both the financial security of the individual, but also implications for the community, and potentially the state. There is a growing interest in why these trends exist, and such research will help inform an adequate policy response. Regardless of the motivation, the lack of insurance increases the vulnerability of communities within the state. Insurance offers the most effective mechanism to provide immediate financial support for disaster recovery. It is in the state's short-term and long-term interest to maintain high penetration of insurance coverage within hazard areas.

Agencies will also continue to build on existing programs to expand guidance for retrofitting buildings and provide financing options through institutions like the Infrastructure Bank. Through collaborative and coordinated efforts the state will support local, regional, and private efforts to increase the resilience of existing infrastructure and development and reduce the cost of future storms, heat waves, and sea-level rise.

"Today many homeowners located in special flood hazard areas are choosing to be uninsured...It is in the state's short-term and long-term interest to maintain high penetration of insurance coverage within hazard areas."



Wildwood, NJ

STRATEGY 1.5: Incentivize Sustainable Growth and Redevelopment that Incorporates Resilience, and Relocation to Safer Places

ACTIONS

1.5.1 Update state incentive and community revitalization programs to consider climate change

1.5.2 Consider new programs that promote investment in communities that have made advancements in resilience

1.5.3 Promote and support affordable housing in safe areas across the state, e.g. by providing incentives and removing obstacles for building of affordable housing in lower risk areas

1.5.4 Ensure state investments minimize future climate resilience needs by continuing to invest in renewable energy and regenerative agriculture (practices that improve the entire ecosystem of the farm such as low- or no-till practices, crop diversity and rotation, crop cover)

1.5.5 Encourage and support use of clean energy in new development and redevelopment initiatives

Hoboken, NJ Northwest Resiliency Pop-up Park

In addition to regulations and public investments, the state influences development patterns through incentive programs. Initiatives like the Main Street New Jersey Program, Transit Village Initiative, and the Brownfield Loan Program have been critical to foster revitalization of communities across the state. They serve to reduce development pressure and growth in undeveloped areas and support revitalization in regions experiencing temporary economic stagnation or decline. With the support of these types of programs, New Jersey has witnessed more growth in areas that are already "built-out" since 2008 than areas that have developable land.[10] Development and redevelopment in areas with existing infrastructure (both physical and social) supports both the state's climate change reduction and resilience goals. Smart growth and sustainability principles such as complete streets and bike/pedestrian programs, diverse housing choices, and a density of social services, are more efficient and serve to maintain the natural resilience of the state's ecological systems. For these reasons, incentive programs will continue to play an important role in building the state's resilience to climate change and minimizing future exposure to climate impacts. As such, state agencies will seek further opportunities to incorporate climate change consideration into program design and criteria.

While existing incentive programs are poised to support climate resilience and adaptation in some communities, they were not created to respond to the unique challenges of climate issues. Therefore, the Interagency Council will continue to research opportunities and programs that reward communities and regions that take proactive measures to reduce exposure to climate change impacts or improve resilience in response to these potential impacts.

By continuing to evolve policy responses and incentive programs, the State positions itself to address emerging issues of paramount importance

to community resilience, such as housing affordability. These underlying, sometimes chronic stressors limit the capacity of an individual or a community to withstand or recover from an acute adverse event. For example, a community cannot be resilient if residents and businesses lack financial capacity to withstand or recover from adverse events. This has been a key lesson in the COVID-19 crisis and will reappear in future crises. New Jersey's affordability issue is not caused by climate change, but climate change is a threat multiplier that will exacerbate the underlying issues driving affordability concerns. There are two significant complex issues with housing affordability as it relates to climate change. The first is ensuring that future housing created to meet affordable housing mandates is developed in low-risk areas, with standards designed for future conditions, planned connectivity to public transportation networks, and in alignment with the 80x50 Report's energy efficiency goals. The second is to maintain affordability within existing housing stock in low-risk areas across all regions of the state so these areas maintain and improve economic diversity. The state will need to consider thoughtful sustainable policy approaches that ensure that resilience measures effectively support affordable housing in safe areas.

Investments in resilience today are predicated on efforts to reduce future climate change impacts by continuing to invest in clean energy, regenerative agriculture (practices that improve the entire ecosystem of the farm such as low- or no-till practices, crop diversity and rotation, crop cover), and sustainable economic policies (e.g. promote/require renewable energy, electrification of public solar energy expansion, expanded recycling industry, sustainable fish farming). While these efforts may not reduce exposure to hazards directly, they contribute to the collective climate change mitigation goals of the state, and if targeted appropriately, can support the social and economic resilience of our communities.

Newark, NJ

New Jersey Economic Development Authority Programs

The New Jersey Economic Development Authority (NJEDA) has numerous lending activities and real estate development activities that can promote climate resilience, sustainable development, job creation and as a result, advance a stronger, fairer New Jersey economy. One central effort at the NJEDA is developing a robust Offshore Wind energy program. The NJEDA actively participates on the Interagency Taskforce on Offshore Wind and recently introduced the "Offshore Wind Technical Assistance Program" to support local companies in the development of the skills and competencies necessary to participate in the Offshore Wind industry.

In addition to creating jobs through new innovative sectors, the NJEDA is committed to investing in community revitalization through its Brownfields Loan Program. This program provides financing to potential brownfield site purchasers and current brownfield sites that intend to develop commercial, such as manufacturing or retail, mixed-use developments, expansions or reuses. The NJEDA has included questions in its loan application, which was approved by the Board of Directors on November 14, 2019, to evaluate the extent of sustainability measures and resiliency considerations undertaken by applicants. Both the Offshore Wind program and the Brownfields Loan Program exemplify the opportunities to invest in communities and create jobs, while strengthening the physical and economic resilience of New Jersey.

STRATEGY 1.6: Integrate Public Health and Community Resilience Planning and Activities

ACTIONS

1.6.1 Integrate public health considerations into climate resilience and hazard mitigation planning, policies, and projects

1.6.2 Enhance capacity for local public health departments to address climate change impacts

1.6.3 Expand use of tools and resources to monitor, assess, and plan for public health impacts of climate change impacts

New Jersey Industrial Haze

Climate change has profound implications for public health and preparing for these impacts will be critical to fostering resilient communities. Increased exposures to heat waves, floods, droughts, and other extreme events will increase deaths and hospitalizations, disrupt health infrastructure, increase transmission of allergens and contaminants, and place stress on mental well-being. Other impacts include shifts in vector-, food- and waterborne diseases, as well as changes in the quality and safety of air, food, and water.[11] In 2021 the DEP and the Department of Health will release an addendum to the Scientific Report on Climate Change that details the latest research on these impacts. Using this resource as a guide, the Interagency Council will work to integrate public health considerations into resilience activities and increase capacity of local health departments and state programs to prepare for climate change. This effort will include a focus on leveraging resources to monitor, assess, and respond to public health impacts of climate change.

The COVID-19 crisis has clearly illustrated the interconnections between public health, economic stability, and community resilience. Integration of climate change resilience and public health efforts has four primary benefits. First, climate change exacerbates many drivers of poor health outcomes, such as air quality, complicating the interventions necessary to reach public health targets. Modifying the interventions to incorporate climate change improves effectiveness of these efforts. Second, the overlap between public health interventions and resilience interventions allows

for resource efficiency and maximization of co-benefits. For example, expansion of green infrastructure may also improve accessibility of green spaces, which has a positive correlation with public health outcomes. Third, the public must recognize climate change as a public health issue. Primary care doctors are considered one of the most trusted voices for providing information on the health impacts of climate change; more than climate scientists. Furthermore, research shows educating Americans on health impacts can increase public engagement and reduce politicization of climate change.[12]

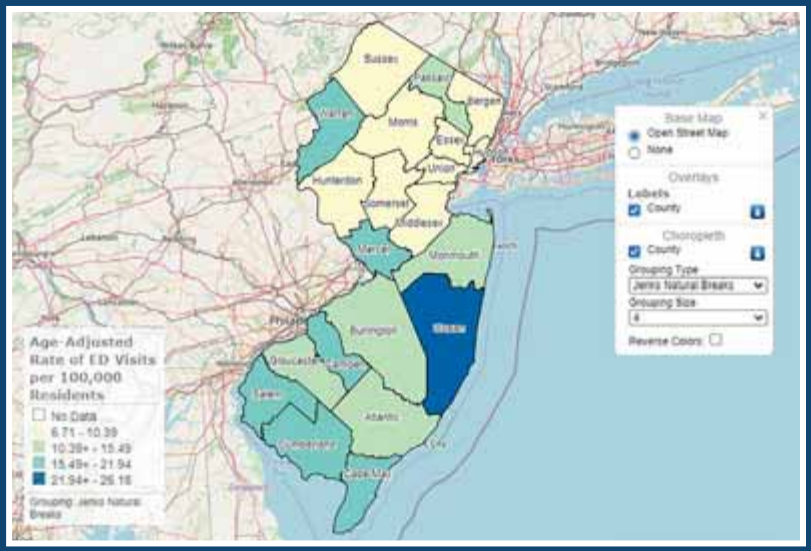
Lastly, public health initiatives have broad support from Americans. A 2018 national survey found that 89 percent of respondents believe public health plays a critical role in the health of their community.[13] The poll also found two-thirds of respondents believed state government should ensure every community has basic health protections with a particular priority for stopping the spread of communicable diseases, bringing together other government agencies in emergencies, protecting air and water quality, and supporting maternal and child health. Furthermore, more than half (57%) of respondents said they would be willing to pay more taxes to ensure such protections.[14] Climate change will affect each of these priority areas, which underscores the intersection between resilience and basic public health provisions. The integration of public health and climate change within New Jersey has the opportunity to accelerate efforts to meet both public health and resilience targets, while expanding awareness and support for climate change preparations through an efficient leveraging of resources and knowledge.

Research has also shown that health interventions are cost effective. Studies have shown that health interventions in high income countries have a return of investment of 14 to 1.[15] There is a strong opportunity to capitalize on co-benefits through the alignment of public health and climate resilience goals.

Health and Equity

"Health equity means that everyone has a fair and just opportunity to be as healthy as possible. This requires removing obstacles to health such as poverty, discrimination, and their consequences, including powerlessness and lack of access to good jobs with fair pay, quality education and housing, safe environments, and health care."[16]

Many health disparities stem from inequities in the opportunities and resources that foster health and well-being. Social determinants of health include living and working conditions, education, income, neighborhood characteristic, social inclusion, and medical care. These social constructs have continually experienced inequitable public investment and harmful public policies that are linked to current inequality metrics. Improving health equity requires increasing opportunities to be healthier for everyone and removing barriers to health, focusing particularly on those who face the greatest social obstacles and have worse health. It also necessitates involving these populations and communities in identifying integrated solutions.[17]



Heat-related Illnesses Age-Adjusted Hospitalization Rates per 100,000, May through September 2015-2019. NJDOH

"Resilience activities should enhance the community's ability to respond better and more efficiently to future adverse situations, not simply return the community to its pre-event baseline."

Princeton, NJ

PRIORITY 1 NOTES:

[1] Rodin, J. and R. Garris. 2012. Reconsidering Resilience for the 21st Century. USAID Frontiers in Development April 2012: 110-120. https://www.usaid.gov/sites/default/files/documents/1868/JudithRodinandRobertGarris.pdf

[2] Rudolph, L., C. Harrison, L. Buckley, and S. North. 2018. Climate Change, Health, and Equity: A Guide for Local Health Departments. Public Health Institute and American Public Health Association. Oakland, CA and Washington, D.C. https://www.apha.org/-/media/files/pdf/topics/climate/climate_health_equity.ashx?la=en&hash=14D2F64530F1505EAE7AB16A9F9827250EAD6C79

[3] NJ Department of Environmental Protection. 2019. About the Bureau of Flood Engineering. https://www.nj.gov/dep/floodcontrol/about.htm

[4] Natural Resources Defense Council. 2021. How States Stack Up on Flood Disclosure. https://www.nrdc.org/flood-disclosure-map

[5] Sweet, W., and J. Park. 2015. From the extreme to the mean: Acceleration and tipping points of coastal inundation from sea level rise. Earth's Future, 2(12). https://agupubs.onlinelibrary.wiley.com/doi/10.1002/2014EF000272

[6] USGCRP. 2018. Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II. United States Global Change Research Program. Washington, DC.

[7] New Jersey Department of Transportation. 2005. Transportation 2030: Assessing New Jersey's Transportation Systems: Final Report. Trenton, NJ. https://www.state.nj.us/transportation/works/njchoices/pdf/assessment.pdf

[8] Kunreuther, H., S. Wachter, C. Kousky, and M. Lacour-Little. 2018. Flood Risk and the US Housing Market. Penn Institute for Urban Research and Wharton Risk Management and Decision Process Center. Philadelphia, PA. https://penniur.upenn.edu/uploads/media/Flood_Risk_and_the_U.S_._Housing_Market_10-30_.pdf

[9] ibid

[10] Evans, T. 2016. Built-Out Places Account for Majority of State's Population Growth Since 2008. New Jersey Future. Trenton, NJ. https://www.njfuture.org/2016/05/20/census-built-out-places-growing/

[11] USGCRP. 2018. Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II. Chapter 4: Human Health. United States Global Change Research Program. Washington, DC. https://nca2018.globalchange.gov/chapter/14/

[12] Salas, R.N., P. Knappenberger P, and J.J. Hess. 2018. Lancet Countdown on Health and Climate Change Brief for the United State of America. Lancet Countdown U.S. Brief, London, United Kingdom. https://www.apha.org/-/media/files/pdf/topics/climate/2018_us_lancet_countdown_brief.ashx

[13] deBeaumont Foundation. 2018. National Survey Reveals Strong Bipartisan Support for Public Health. Bethesda, MD. https://debeaumont.org/news/2018/national-survey-reveals-strong-bipartisan-support-for-public-health/

[14] ibid

[15] Trust for American's Health. 2019. The Impact of Chronic Underfunding on America's Public Health System: Trends, Risks, and Recommendations. Washington, DC. https://www.tfah.org/report-details/2019-funding-report/

[16] Braveman P., E. Arkin, T. Orleans, D. Proctor, and A. Plough. 2017. What Is Health Equity? And What Difference Does a Definition Make?. Robert Wood Johnson Foundation. Princeton, NJ.

[17] ibid

PRIORITY 2:

STRENGTHEN THE RESILIENCE OF NEW JERSEY'S ECOSYSTEMS

INTRODUCTION

Not only are New Jersey's ecosystems central to its identity as the Garden State and quality of life, but they are also enjoyed and treasured by citizens and visitors alike. To be resilient, New Jersey must ensure that its ecosystems are resilient. The health of an ecosystem directly affects the health and well-being of New Jersey residents who live and work near them and the economies that rely on those ecosystems. If water quality is poor, for example, ecological, human, and economic systems suffer. The Interagency Council recognizes that a wholistic approach to climate resilience must strengthen the resilience of our ecosystems. As a priority, strengthening ecosystems serves as a resilience strategy in two ways. First, by supporting the health and diversity of ecosystems, they continue to provide valuable services as the climate changes. These ecosystem services are an important tool for building resilience. With ecosystem services ranging from water filtration and flood attenuation to food production and carbon sequestration, New Jersey residents rely on their natural environment for clean air and water regardless of where they live or work. Though their intrinsic value is priceless, the value of ecosystems goes far beyond aesthetics and recreation. In financial terms, the annual value of ecosystem services in New Jersey was estimated to be $8-19 billion,[1] many of which will lessen the impacts of climate change. Second, nature-based interventions can be less expensive alternatives to hazard mitigation or hard engineering measures, while providing additional value and services. For example, some the most valuable and cost-effective of those mitigation services come from wetlands, which also provide vital habitat and opportunities for recreation.[2]

Treefrong in the Pine Barrens

Beaver Habitat at the Plainsboro Preserve

"The health of an ecosystem directly affects the health and well-being of New Jersey residents who live and work near them and the economies that rely on those ecosystems."

STRATEGIES:

2.1 Promote Resource Conservation and Natural Lands Management to Strengthen Ecological Resilience

2.2 Manage Agricultural Lands, Forests, and Other Ecosystems for Climate Impacts and Environmental Stressors

2.3 Deploy Natural and Nature-based Solutions for Resilience

STRATEGY 2.1: Promote Resource Conservation and Natural Lands Management to Strengthen Ecological Resilience

ACTIONS

2.1.1 Consider future climate conditions in conservation and protection decisions

2.1.2 Expand protection of lands and waterways to safeguard ecosystem health

2.1.3 Restore damaged and degraded ecosystems to enhance their ability to perform resilience-related services

2.1.4 Provide habitat connectivity and corridors to support wildlife adaptation to changing conditions

Stokes State Forest

New Jersey's natural areas are valued as natural, scenic, and recreational resources for public use and enjoyment. State parks, nature preserves, rivers, and open space are often thought of as perfectly preserved areas set aside for the enjoyment of their visitors. Though idyllic, this surface-level view of natural lands and resources does not recognize the values and services these areas provide or the vulnerabilities they face. The warmer temperatures and altered precipitation patterns projected due to climate change will result in these special places looking and functioning differently, which can impact water quality and supply, flood protection, and air quality in adjacent communities. The ability of ecosystems to adapt to changing conditions is thus important to the state's overall resilience to climate change. If forests in a public space are unable to adapt to a changing climate, for example, the surrounding community may face locally higher temperatures and diminished air quality. As a threat multiplier, climate change will exacerbate the impacts of existing stressors such as pollution, fragmentation, and invasive species, threatening the ability of nature to serve its critical functions. Protecting our natural systems and restoring degraded landscapes ensures the existence of our cherished natural areas, but also serves to safeguard our communities from the impacts of climate change by using the power of nature itself. Importantly, protecting these resources also helps reduce the greenhouse gas pollution that drives climate change. Through this strategy, the State will use its conservation efforts to strengthen ecological resilience and use ecosystem services to address climate threats.

Although not initially created with climate change in mind, several existing land management and preservation programs help promote resilience. For example, the Department of Environmental Protection (DEP) administers the Green Acres Program to protect open space as well as natural, historic, and cultural areas for public use and enjoyment. By creating a system

of interconnected open spaces, the Green Acres Program preserves and enhances New Jersey's natural environment, and in turn, its resilience to climate change. Together with public and private partners, the Green Acres Program has protected over 500,000 acres of open space around New Jersey. Due to fiscal constraints, there are often more potential properties to protect than funds to protect them. Conservation programs use a variety of factors to prioritize where to spend their limited resources; some statutory, some policy. During that prioritization process, future climatic conditions should be taken into consideration. These large contiguous preserved lands will support wildlife as it begins to move to more suitable areas. The DEP has begun to plan for facilitation of that movement through its Changing Habitat Across New Jersey (CHANJ) program. CHANJ is an effort to make landscapes around the state more permeable to wildlife by identifying key areas and actions to achieve habitat connectivity. By using the best-available science in programs such as CHANJ to inform preservation and conservation decisions, state agencies can help ensure that investments in nature will be best targeted and protected from loss.

Setting aside pristine lands and waters is not the only ecological approach to resilience in which the Interagency Council sees value. Restoring degraded resources to their natural status is also a useful tool for building resilience to climate change. Degraded areas that have been negatively impacted by pollution or hazards have diminished value for our communities and our resilience. The DEP's Office of Natural Resource Restoration works to restore and enhance damaged resources, which expands ecosystem services and revives ecosystem health to the benefit of local communities. Restoration is not limited to contaminated sites. For example, the DEP's Blue Acres program has restored a floodplain ecosystem in Linden, Union County in an area where it acquired frequently flooded properties through its floodplain buyout acquisitions. The Linden project not only increased flood resilience, but also enhanced the ecological functions of the area. Capturing the synergies between ecological restoration and community resilience is thus a powerful strategy for New Jersey.

Nantuxent Wildlife Management Area

Harmful Algal Blooms (HABs)

HABs in New Jersey

In October 2019, the DEP announced $13.5 million dollars in funding to implement innovative projects and technologies to mitigate and prevent harmful algal blooms (HABs) in lakes and public waters throughout New Jersey.[3] Naturally occurring in lakes and ponds, the algae-like bacteria that causes these blooms can proliferate to unsafe, levels and produce toxins under certain conditions, including warm weather, high-nutrient, stagnant waters, and sunshine. Climate change is expected to exacerbate the problem of HABs, resulting in an acute public health threat from drinking and recreating in affected waterways. Ecosystems, wildlife, pets, and livestock can also be negatively impacted. In turn, businesses that rely on the use of New Jersey's waterways are also impacted. The State's investment to protect waters that are vulnerable to harmful algal blooms in turn boosts the resilience of those waters and communities that rely on them.

STRATEGY 2.2: Manage Agricultural Lands, Forests, and Other Ecosystems for Climate Impacts and Environmental Stressors

ACTIONS

2.2.1 Reduce wildfire risk through risk assessment and proactive management

2.2.2 Develop an ocean acidification action plan to address impacts to fisheries, aquaculture, and ocean resilience

2.2.3 Incorporate adaptive management and future conditions into state land and resource management plans and operations

2.2.4 Create landowner assistance programs to encourage farmers, foresters, and other resource managers to incorporate changing future conditions into their management practices

Cranberry Bogs, New Jersey Pine Barrens

As the Garden State, New Jersey's farms, forests, and other working lands are vital to the state's economy and identity. Wildfires, rising temperatures, invasive species, and other climate impacts threaten not only the state's preserved landscapes, but also the working lands that provide us with food and resources. For example, shifts in temperature and precipitation patterns may make it unsuitable to grow New Jersey-iconic crops such as blueberries and cranberries.[4] Incorporating climate change considerations and scientific data into management and operations will help keep the natural resources and agricultural sectors resilient while also supporting the state's economy with the more than $1 billion in revenue the sectors produce annually.[5] To keep managed and working lands resilient to climate impacts, agencies have begun to incorporate climate considerations into management plans and decision-making.

A key element of protecting managed landscapes to promote resilience is to mitigate and prevent hazards that negatively affect the environment, such as wildfires. The approach to building resilience to the threat of wildfire is twofold: understand the risk and conduct preventative management. To that end, the NJ Forest Fire Service (Service) is developing a Wildfire Risk Assessment Portal (WRAP) to provide a standard tool for quantifying and interpreting wildfire hazard and risk statewide. With the information from WRAP, the Service can target preventative management in at-risk areas.

Foresters have many management techniques which help reduce wildfire risk across the state and enhance forest health. These include treatments

Prescribed Burning

"A key element of protecting managed landscapes to promote resilience is to mitigate and prevent hazards that negatively affect the environment, such as wildfires."

to mechanically remove excess hazardous fuels and brush by thinning overstocked forests or creating fire breaks to contain fires that do occur. Prescribed burning—purposefully igniting an area under safe conditions to consume hazardous fuels—is an additional method foresters have to mitigate wildfire risk. Having both the state government and private landowners taking steps to reduce wildfire risk will help build resilience across larger swaths of New Jersey's landscapes.

Addressing ecological resilience of managed landscapes is more efficient when done at large scales. New Jersey is taking advantage of partnerships that work across land ownership boundaries to expand landscape-scale resilience. For example, the DEP secured funds through the U.S. Department of Defense's Readiness and Environmental Protection Integration program to implement resilience projects near New Jersey's military installations. Projects in this State-Federal partnership will include living shorelines and beach nourishment, developing firebreaks, and enhancing stormwater management in the communities and landscapes adjacent to military facilities.

In response to the impacts that climate change will bring, resource managers must not only prepare for random and unpredictable events like wildfires, but also for the more predictable changes in environmental conditions that the science projects. Climate change will impact all of New Jersey's natural resources, and so management plans such as crop planting schedules, fishery quotas, and forest management plans must also be adaptive as conditions continue to evolve and new data becomes available. This method of adaptive management takes an iterative approach designed to expect and respond to uncertainty and variability of resources over time. By incorporating adaptive management and future conditions into planning, managers can ensure that their resources are best prepared for a changing climate. Fisheries, for example, are a vital component of New Jersey's economy, supporting important recreational and commercial opportunities valued at approximately $2 billion annually.[6] Yet, ocean acidification poses serious threats to marine environments and the fisheries they support due to changes in the chemistry of ocean water.[7] As the ocean becomes more acidic, shellfish become weakened and their survival is threatened. The DEP is developing strategies to address ocean acidification and adapt fisheries, aquaculture, and marine management to future conditions. It will be vital to monitor any shifts induced by ocean acidification and climate change so that information can be used to protect the resource itself and the economy that relies on it.

The Interagency Council recognizes that understanding climate change science and incorporating it into plans and operations is not easy. The Department of Agriculture and DEP offer technical and financial assistance for management and planning through multiple programs and partnerships, including the Office of Aquaculture Coordination, and Forest Stewardship Program, respectively. These agencies can expand their technical assistance and support to private land managers, farmers, fishers, and foresters through further development of policies and guidance so that New Jersey's natural resource management and agriculture incorporates climate change, regardless of ownership.

Plainsboro/Princeton, New Jersey

STRATEGY 2.3: Deploy Natural and Nature-based Solutions for Resilience

ACTIONS

2.3.1 Create a homeowner assistance program to encourage use of nature-based shoreline stabilization statewide

2.3.2 Prioritize investment in green infrastructure to augment water quality protection and stormwater management, particularly in underserved communities

2.3.3 Deploy urban and community forestry solutions for heat mitigation, stormwater retention, beautification, and air quality benefits

Rain Garden

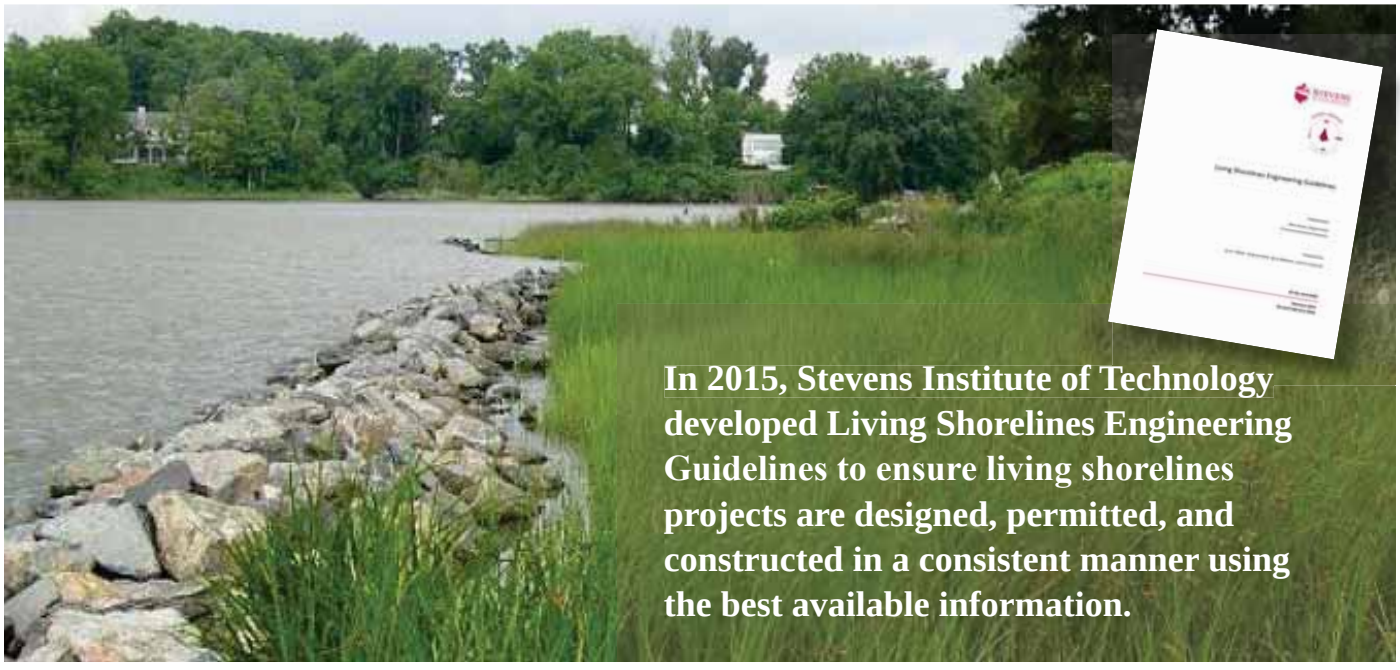
Harnessing the power of nature through natural and nature-based solutions supports multiple resilience goals. Natural and nature-based solutions are resilience interventions that utilize natural ecological processes to reduce negative environmental impacts. Some common examples include trees reducing heat impacts, living shorelines that protect against erosion, and green infrastructure vegetation that absorbs precipitation. Natural and nature-based solutions can complement or act as alternatives to gray or hard infrastructure projects. These softer methods are frequently more cost-effective and can even outperform traditional approaches. For example, a 2014 study found that areas with more natural shorelines were better protected from erosion during Hurricane Irene than those with bulkheads.[8] Natural and nature-based solutions also often offer the additional benefit of providing ecosystem services beyond just the intended use, including beautification, carbon sequestration, habitat creation, and recreational opportunities. Under the Department of Transportation's *Complete and Green Streets for All* guidance, the agency promotes integrating natural features into transportation improvement projects as a method to capture those powerful co-benefits.

"Residents in urban and environmental justice communities are disproportionately affected by climate impacts, such as extreme heat. Using green infrastructure and community forestry in these and other communities will provide incredible co-benefits to local areas, such as expanded open space."

Liberty State Park

A survey of stakeholders during the development of this *Climate Change Resilience Strategy* revealed that participants want to see state agencies increase the use of nature-based measures more than any other type of action. While state agencies have made significant strides in expanding the use of some natural measures to address erosion and other impacts, challenges still exist for further expansion. Some techniques, such as living shorelines, for example, are most often associated with the coast, but there are opportunities to apply this approach elsewhere in the state to stabilize waterways impacted by increases in precipitation. By improving communication and providing technical assistance, state agencies can educate homeowners on the efficacy of natural shorelines as resilience measures. A concerted homeowner assistance program consisting of education, technical assistance, and financial incentives would help ensure that ecosystem-based solutions are more widely known and applied. In addition to education and outreach, the program could include grants for designing projects and other financial incentives, such as tax credits, which are offered in several states.

As the state government invests in natural infrastructure across New Jersey, targeted investments should be prioritized in underserved communities. Residents in urban and environmental justice communities are disproportionately affected by climate impacts, such as extreme heat. Using green infrastructure and community forestry in these and other communities will provide incredible co-benefits to local areas, such as expanded open space. Similarly, planting urban trees not only reduces heat impacts, but also helps clean the air, store stormwater, and add aesthetics to communities. Given limited public resources, using diverse, cost-effective nature-based options allows state agencies to support underserved communities, while confronting climate impacts and maximizing ecosystem services.



In 2015, Stevens Institute of Technology developed Living Shorelines Engineering Guidelines to ensure living shorelines projects are designed, permitted, and constructed in a consistent manner using the best available information.

Pervious pavement, landscaping, and bioswale areas captures stormwater runoff.

Green Infrastructure in Stormwater Rules

Stormwater runoff is a major source of water pollution throughout New Jersey and across the nation. Every day, runoff from storms carries fertilizers, pesticides, automotive fluids and other pollutants into waterways, degrading ecosystems and impairing lakes, streams, and rivers. Poorly controlled stormwater also exacerbates dangerous flooding conditions, and the increase in projected rainfall and extreme weather due to climate change creates added risk for harm to people and property from stormwater runoff.

In March 2020, DEP formally adopted amendments to the state's stormwater management rules to better protect water quality by reducing polluted runoff through use of green infrastructure technologies. The amendments include a requirement for permit applicants to use green infrastructure, rather than more traditional engineered structures, to reduce stormwater runoff and achieve water quality goals. Green Infrastructure is typically used to refer to methods to manage stormwater through approaches that mimic natural hydrologic processes in developed areas.

This approach more naturally manages stormwater, allowing better infiltration of above-ground stormwater into the ground water deeper beneath our feet. This infiltration process is simple and nature-based: it uses vegetation and soil to naturally filter out pollutants. Green infrastructure can also include ways to store some stormwater runoff for later beneficial reuse, such as irrigation. In addition to protecting and better managing stormwater, these approaches beautify communities and help in the fight against climate change by creating carbon-sequestering green space. Creating these green spaces also mitigates the heat-island effect caused by development and pavement, which can raise average temperatures in urban areas relative to less developed areas.

PRIORITY 2 NOTES:

[1] New Jersey Department of Environmental Protection. 2007. Valuing New Jersey's Natural Capital: An assessment of the economic value of the state's natural resources. Pages 4-5. Trenton, NJ. https://www.nj.gov/dep/dsr/publications/Natural_Capital_Full%20Report.pdf

[2] Reguero, B. G., M.W. Beck, D.N. Bresch, J. Calil, and I. Meliane. 2018. Comparing the cost effectiveness of nature-based and coastal adaptation: A case study from the Gulf Coast of the United States. PloS one 13(4), e0192132.

[3] New Jersey Department of Environmental Protection. 2019. Harmful Algal Blooms (HABs) Initiative Fact Sheet. Trenton, NJ. https://www.nj.gov/dep/hab/download/HABs_factsheet111419.pdf

[4] Frumhoff, P. C., J. J. McCarthy, J. M. Melillo, S. C. Moser, and D. J. Wuebbles. 2007. Confronting climate change in the U.S. Northeast: Science, impacts, and solutions. Synthesis report of the Northeast Climate Impacts Assessment (NECIA). UCS Publications, Cambridge, MA.

[5] U.S. Department of Agriculture's National Agricultural Statistics Service. 2019. 2017 Census of Agriculture: New Jersey State and County Data. https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/New_Jersey/njv1.pdf

[6] New Jersey Department of Environmental Protection Bureau of Marine Fisheries. 2020. https://www.nj.gov/dep/fgw/marfhome.htm

[7] United Nations Environment Programme. 2010. Environmental consequences of ocean acidification: a threat to food security. Pages 3-10. Nairobi, Kenya. https://oceanfdn.org/sites/default/files/Environmental_Consequences_of_Ocean_Acidification.pdf

[8] Gitmann R.K., A.M. Popowich, J.F. Bruno, and C.H. Peterson. 2014. Marshes with and without sills protect estuarine shorelines from erosion better than bulkheads during a Category 1 hurricane. Ocean and Coastal Management 102: 94-102. https://dx.doi.org/10.1016/j.ocecoaman.2014.09.016.

PRIORITY 3:

PROMOTE COORDINATED GOVERNANCE

INTRODUCTION

Climate change impacts will touch every aspect of state and local government, just as they will affect every sector of New Jersey's economy, and every citizen of the state. In practice, this means that the State must come together to enhance resilience to climate change impacts. Without a concerted effort to address climate change impacts, the state government would risk being unprepared, disorganized, or with inconsistent and conflicting approaches to complicated problems. Executive Order 89 mandates that the Executive Branch "shall take proactive and coordinated efforts"[i] to promote resilience; a whole-of-government approach to climate resilience that is necessary and required. State agencies build on the foundation of Executive Order 89 by expanding opportunities for collaborative governance. Therefore, state agencies must integrate climate change into all practices, making it business as usual and not a supplementary consideration. By viewing the operations of government through a climate resilience lens, the state government will be able to confront the coming impacts in a proactive manner. This priority proposes actions that will establish the processes and governance structure necessary to confront climate change as a unified state government.

Newark, NJ City Hall

New Jersey State Senate, Trenton, NJ

STRATEGIES:

3.1 Ensure Continuing Efforts by the Interagency Council on Climate Resilience to Lead a Coordinated, Whole-of-government Approach to Resilience

3.2 Actively Engage Local Governments and Other Partners to Develop Resilience Solutions

3.3 Incorporate Equity and Inclusion in Resilience Decision-making

[i] Executive Order 89, 51 N.J.R. 1707(a). 2019. https://nj.gov/infobank/eo/056murphy/pdf/EO-89.pdf

STRATEGY 3.1: Ensure Continuing Efforts by the Interagency Council on Climate Resilience to Lead a Coordinated, Whole-of-Government Approach to Resilience

ACTIONS

3.1.1 Strengthen the engagement and leadership role of the Interagency Council in driving resilience and adaptation in state policy

3.1.2 Establish resilience officer positions at all state agencies with responsibility for internal resilience efforts and interagency coordination by designating an existing employee

3.1.3 Create resilience action plans at each agency with standard goals and metrics

3.1.4 Share data across agencies through an interagency web portal

3.1.5 Share information that may impact resilience through the Interagency Council to communicate progress and promote alignment with the state policy

Interagency Council on Climate Resilience

Climate resilience is a ubiquitous challenge that requires specific attention across all state agencies. To rise to this challenge, New Jersey's institutions must evolve to reflect that climate change is a threat to their missions and constituents. Addressing climate change requires a level of integration, mobilization of resources, political will, and sustained commitment that can only be driven through government-wide leadership. The Interagency Council on Climate Resilience (Interagency Council) established by Governor Murphy's Executive Order 89 was designed to fill that role. Governor Murphy also signed Executive Order 221 establishing the Office of Climate Action and the Green Economy, which will focus on the interlocking priorities of addressing climate change, ensuring New Jersey's clean energy future, and transitioning to a green economy while prioritizing equity and environmental justice. Together, the Interagency Council and Office of Climate Action and the Green Economy will lead New Jersey's comprehensive response to climate change.

Comprised of seventeen state agencies, the Interagency Council was established to develop short- and long-term action plans that will promote the mitigation, adaptation, and resilience of New Jersey's economy, communities, infrastructure, and natural resources. This clear mandate empowers the group to take a leading role in developing statewide climate resilience policies beyond the development of this document. In a leadership capacity, the Interagency Council is tasked with spearheading resilience policy development, providing guidance and standards to agencies, and coordinating and driving state resilience actions across the

entire Executive Branch. The Interagency Council will use issue-specific working groups, frequent information sharing, and a shared vision for resilience to fulfill this mandate.

While this *Climate Change Resilience Strategy* will serve as a roadmap for broad action by the Interagency Council, individual state agencies will also design and implement their own resilience actions that more specifically address their responsibilities, authorities, and stakeholders. Agency-specific action plans will give them not only the opportunity to assess their needs, but also provide a guiding blueprint for their work moving forward. The Department of Environmental Protection (DEP) is already undertaking such a review, which could serve as a model for other agencies. The Interagency Council will seek to develop standard metrics or goals for use in all agency plans so that agencies can more easily track statewide progress.

In addition to leading the effort to develop this *Resilience Strategy*, the State Chief Resilience Officer position created by Executive Order 89 has the responsibility of coordinating the DEP's policies, programs, and activities to plan for and address the current and anticipated impacts of climate change. Other agencies would also benefit from executive support to pursue this work with dedicated resources. Designating an existing employee as an executive level liaison or resilience officer position at each agency would be a meaningful step to ensure that climate change is adequately prioritized across the state government.

The steps that any individual agency takes are important not only to bolstering its own resilience to climate change, but also to supporting the entire state government, collectively. State agencies will work cooperatively to actively integrate activities across programs and address conflicts or barriers to promoting resilience. The Interagency Council will be the forum for increased collaboration, oversight, and communication that ensures that state agency efforts all build to the same goals and use standard information when making decisions. Discussions by the Interagency Council have already identified several areas that would benefit from agencies working more closely together. For example, regular data and information sharing through the Interagency Council can help prevent policies from conflicting; building an interagency web portal to share data will aid this effort. A coordinated approach will also provide non-state entities like municipalities and businesses a level of certainty so that they will receive consistent guidance on their activities across multiple agencies. The Interagency Council will strengthen that certainty by providing regular updates and sharing information with the public throughout policy development and implementation. This transparency from state agencies will increase public confidence and participation in New Jersey's resilience work, both of which are necessary for effective governance.

ACTIONS

3.1.6 Promote transparency by regularly sharing information with external groups and partners

STATE AGENCIES ON THE INTERAGENCY COUNCIL

STRATEGY 3.2: Actively Engage Local Governments and Other Partners to Develop Resilience Solutions

ACTIONS

3.2.1 Develop active communication channels between the Council and local governments to ensure transparency and an exchange of ideas

3.2.2 Create opportunities for local governments to work with the Interagency Council

3.2.3 Encourage local and regional entities to designate a champion responsible for reporting local resilience work to the state

3.2.4 Partner with academic institutions to offer resilience planning and design services, and demonstration projects

NJ FRAMES Local Outreach

This *Resilience Strategy* is focused on actions and policies that state agencies can take to promote climate resilience. However, a true wholistic approach to climate change for New Jersey will involve active engagement from outside state government and include local and county governments, businesses, academic institutions, and nongovernmental organizations, all of which have a role in New Jersey's resilience.

The Interagency Council seeks to develop strong relationships with local and county governments, federal agencies, and other state agencies not currently part of the Interagency Council. Each comes with different authorities, obligations, resources, and perspectives that are critical considerations in designing state policies and actions. Local officials have intimate knowledge of their community needs and specific situations, making the 21 counties, 565 municipalities, and 584 school districts in the state key partners in governing climate resilience actions. The Interagency Council will establish processes for regular communication, transparency, and information sharing with other governmental entities. Local and regional governments can help facilitate this by designating a single champion to liaise with the State. By recognizing which entities are best suited to tackle individual aspects of resilience, New Jersey can more efficiently address resilience.

The field of climate resilience is constantly evolving, with both public and private sector groups developing new ways to confront climate impacts. Private companies have a long history of evolving to meet changing market conditions and growing competition. This expertise and culture of innovation, combined with the ubiquitous nature of climate change, makes external partnerships crucial to the Interagency Council's efforts. New Jersey's Office of Innovation already works collaboratively to drive innovation and improve the design and delivery of policies and services to residents, businesses, and institutions. There is a wealth of academic and private sector expertise located in New Jersey that can be leveraged to help identify and accelerate innovative resilience solutions. For example, state agencies can work with academic institutions to develop pilot projects that demonstrate the efficacy of innovative resilience ideas. State agencies will build on existing relationships and look for new partners for all aspects of its resilience work, from research and analysis to project delivery and public engagement.

"... a true wholistic approach to climate change for New Jersey will involve active engagement from outside state government and include local and county governments, businesses, academic institutions, and nongovernmental organizations."

ACTIONS

3.2.5 Partner with the NJ Office of Innovation to develop creative solutions to project delivery, public engagement, and policy design

3.2.6 Engage innovative non-governmental thought leaders to support the Interagency Council

Passaic County Court House, Paterson, NJ

STRATEGY 3.3: Incorporate Equity and Inclusion in Resilience Decision-Making

ACTIONS

3.3.1 Provide opportunities for equity leaders to have meaningful involvement in support of the Interagency Council

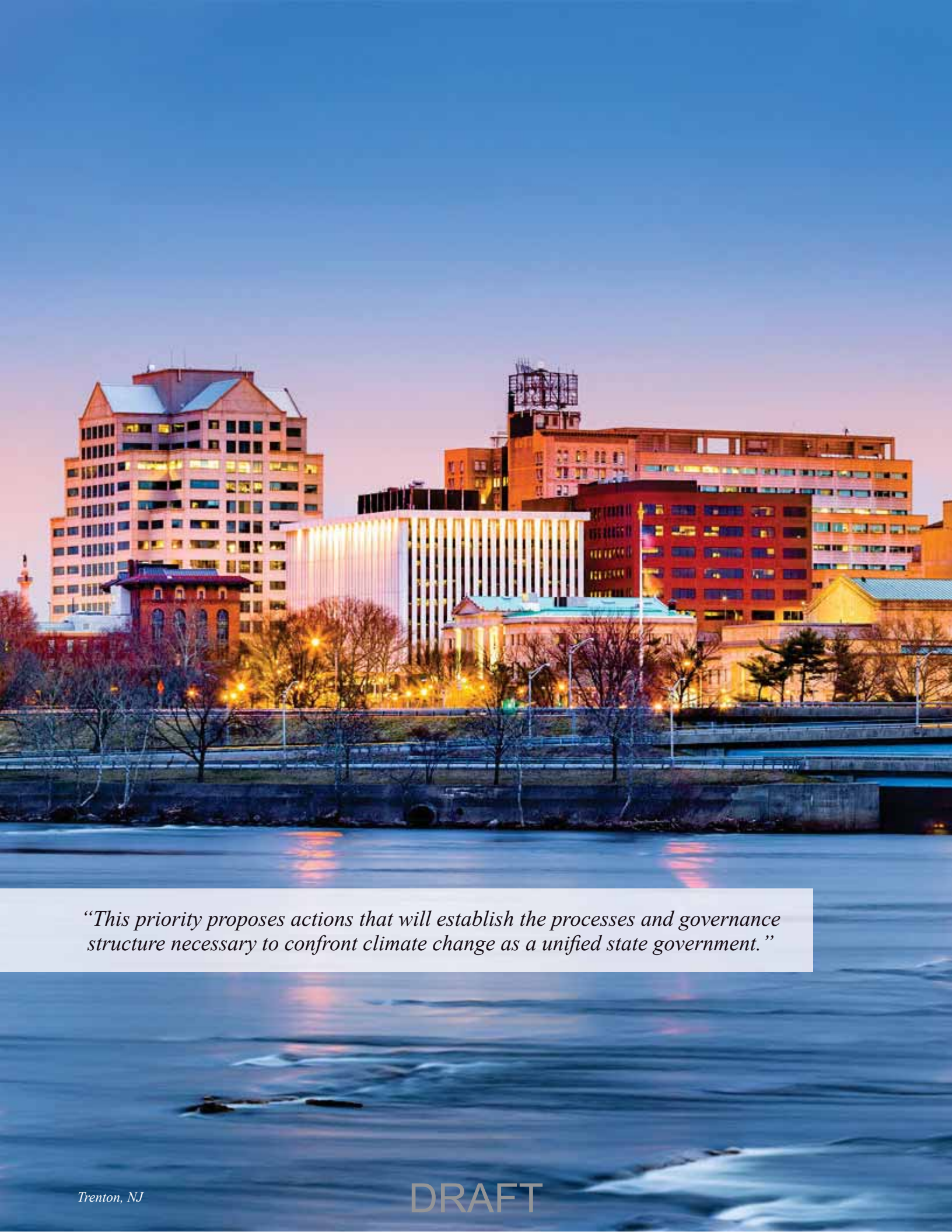
3.3.2 Empower community members and organizations to participate in appropriate state agency processes

3.3.3 Develop guidance for how to integrate social vulnerability and environmental justice considerations into resilience planning

Rebuild by Design Outreach

Prioritizing inclusion and equity is crucial to building a just and successful response to climate change. In seeking partners and crafting policy, the Interagency Council recognizes that underserved and socially vulnerable populations not only deserve a seat at the table but deserve a voice in decision-making processes. New Jersey state agencies are already tasked with incorporating environmental justice considerations into planning, regulatory programs, and funding opportunities per Governor Murphy's Executive Order 23, the Furthering the Promise guidance, and the landmark environmental justice law enacted in September of 2020. The Interagency Council on Climate Resilience will work with the recently established Interagency Council on Environmental Justice to ensure that the principles of environmental justice identified by impacted communities are incorporated into climate resilience policy development.

Climate change is placing and will continue to place a unique burden on vulnerable. underserved populations across New Jersey. These disproportionate effects must be considered as the state government works to enhance its resilience for all New Jerseyans. State agencies can expand existing efforts to include more specific provisions for equitable involvement of underrepresented groups and their representative community organizations in resilience policymaking and other state agency processes. This deeper involvement will ultimately lead to better solutions to systemic issues. State agencies can also provide direct assistance and funding to projects that wish to engage underserved groups in resilience activities and provide guidance on how to measure the effectiveness of the engagement in those activities. Through the Interagency Council, agencies will work collaboratively to develop guidance to help integrate social vulnerability and environmental justice concerns into resilience planning. Finally, state agencies can create opportunities to evaluate the equity of outcomes for projects and programs that affect or involve underserved populations as they are implemented and afterwards.

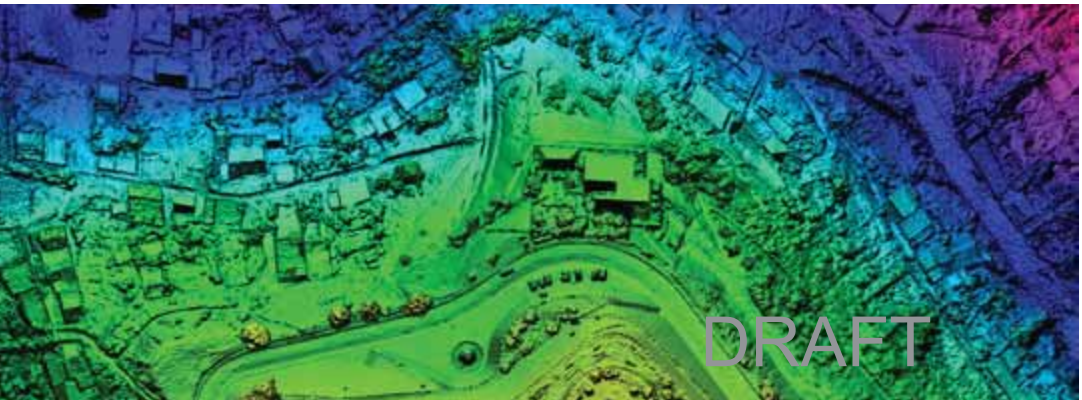


"This priority proposes actions that will establish the processes and governance structure necessary to confront climate change as a unified state government."

Trenton, NJ

PRIORITY 4:

INVEST IN INFORMATION AND INCREASE PUBLIC UNDERSTANDING



INTRODUCTION

Climate change will affect every resident, business, and resource within New Jersey in some way. Through the advancement of scientific research, there is more knowledge and understanding of these impacts now than there was even five years ago. Scientists are learning more every day about how current trends are being influenced by climate change and what people may experience in the future. These data can help inform planning and governance at every level, but only if that information is provided in actionable ways. The state has an opportunity to support individual, local, regional, and state resilience by investing in applied research efforts, communication campaigns, and training programs. Through these initiatives the state can raise awareness and enable science-based decision-making in response to climate change.

Americorps Watershed Ambassadors Program

Rebuild by Design Outreach

"The state has an opportunity to support individual, local, regional, and state resilience by investing in applied research efforts, communication campaigns, and training programs."

STRATEGIES:

4.1 Expand Public Communication Efforts on Climate Change and Impacts on New Jersey

4.2 Expand Climate Change Education and Training Opportunities

4.3 Develop a State-wide Climate Change Vulnerability Assessment

4.4 Build a Collaborative Research Agenda to Guide Future Cimate Resilience Research

STRATEGY 4.1: Expand Public Communication Efforts on Climate Change and Impacts on New Jersey

ACTIONS

4.1.1 Build a state-wide clearinghouse website for all climate change and resilience information

4.1.2 Launch a multi-platform climate communication campaign to increase the awareness of all New Jerseyans about climate change impacts and how to increase resilience

4.1.3 Leverage partnerships and technology to expand opportunities for communication and engagement with members of the public and all levels of government

DEP's 2020 Social Media Campaign on Climate Science

A 2019 poll from the Rutgers Eagleton Institute reported that two-thirds of New Jersey residents are concerned about climate change[1] or deem it a major problem or crisis[2]. Additionally, while 64% of residents say they know some or a lot about how climate change might affect their lives in the future, a striking 42% report knowing little or nothing at all about how to prepare.[3] A similar 2020 Pew Research poll found that 81% of Americans rely "a lot" on their own research before making a major decision.[3] Yet, just one in ten residents frequently get climate change information from state government.[1] These statistics highlight the need for a comprehensive climate change and resilience information campaign at the state level. A core objective of this strategy and the actions that stem from it is to help New Jerseyans understand climate change risks and how individuals and communities can become more resilient.

During the preparation of this strategy, stakeholders noted that they have trouble finding relevant information on state and federal websites. There is not a central repository or dashboard that helps users understand the various agencies and programs that support climate resilience efforts. This information is frequently buried within broader websites, and without knowing exactly which agency and/or program is the correct resource, they can be difficult to navigate. Given the Department of Environmental Protection's (DEP) leading role in reducing and responding to climate change, it was the first state agency to create a dedicated webpage to climate change. Over the past year, DEP has updated this webpage to become a central agency clearinghouse of all climate change-related information and links to relevant DEP programs. The DEP will continue to update

this website to address the need for a comprehensive source of data, tools, guidance, and information related to climate change science and response strategies, but this website could migrate to a statewide site to improve its effectiveness, like, for example, the clearinghouse websites developed by California and Massachusetts. The state's own COVID-19 dashboard serves as a good model of an effective central source for information on a cross-jurisdictional concern.

"A core objective of this strategy and the actions that stem from it is to help New Jerseyans understand climate change risks and how individuals and communities can become more resilient."

Building an online information clearinghouse is an important measure to increase accessibility to climate information, but it is a passive solution. Agencies should also take proactive steps to increase understanding and awareness of climate change impacts. The statewide response to the current COVID-19 health crisis serves as a model for this need as well. Throughout the COVID-19 crisis, the state used social media, news outlets, and marketing techniques to increase public awareness and update the public on specific policy measures. At the local level, elected officials and municipal staff explored new and creative opportunities to provide real-time information to residents on new or modified restrictions, as well as information about testing and data on cases. For these reasons, any channel and method that was successful for public communication on the existing health crisis should be considered in development of future information on climate change impacts. Future campaigns may also be modeled on other successful public education and awareness efforts across the nation that have help shaped public understanding of recycling, water use, water quality, and energy use.

At a minimum, the broader action to develop a large-scale communication campaign should integrate climate change into current state agency education and outreach efforts related to public health, land use, ecosystems, water resources, coastal management, agriculture, forests, and infrastructure. It may also involve the preparation of materials that can be used in local education and communication campaigns and methods for specific audiences including, but not limited to businessowners, homeowners, and short- and long-term renters.

To be effective with such a broad social impact campaign, the state will need to utilize partnerships and technology to expand its reach. This could include working with traditional media and social marketing techniques. Agencies should increase engagement with community-based organizations in that work with socially vulnerable populations, particularly in underserved areas to co-create specific materials and campaigns to reach these populations. Additionally, initiatives could leverage existing programming at public, non-profit, and academic organizations to incorporate climate information into public outreach and education initiatives. Projects under this action may use innovative community-based communication approaches, such as art installations and a story-based strategy to communicate risk, impacts, and community visions of climate justice, resilience, and transformation. These are just a few examples of creative ways New Jersey can educate its residents about climate impacts.

The state should issue a follow-up poll within the next five years to analyze the effectiveness of these communication initiatives and modify as needed.

DEP's Climate Change Webpage

DEP's dedicated climate change website provides information on climate change science, mitigation, resilience, and ways you can take action

The webpage is available at:
www.nj.gov/dep/climatechange/

Risk Communications Campaign

Risk can be perceived very differently by populations that experience similar kinds of events based on culture, economic practices, education, and length of time which they are impacted. As such, it is not enough to relay to people that they are at risk, but it is necessary to help them understand, through compelling and clear messaging, what can be done so they feel empowered to take action.

The Coastal Management Program at DEP, with support from NOAA, has partnered with the New Jersey State Council on the Arts and the Jacques Cousteau National Estuarine Research Reserve (JC NERR) to develop and risk communication campaign to provide state and local decision-makers the tools to better communicate the risks and impacts of coastal hazards such as sea-level rise, tidal flooding, and coastal storms. The campaign includes development of risk communication infographics and material that will be used in to engage the public through social media; establishment of the NJ Climate Resilience Public Art Grant Program that will pair community-based organizations and local artists to create art installations throughout the coastal zone; and, will bring NOAA's "Building Risk Communication Skills" training to local decision-makers to provide new skills, tools, and insights that lead to desired behavior changes

The social media campaign and art installations will kick-off in the summer of 2021.

Monmouth Beach, NJ

STRATEGY 4.2:
Expand Climate Change Education and Training Opportunities

Rebuild by Design Outreach

In 2019, New Jersey updated its school curriculum standards to include climate change so that tomorrow's leaders will have a strong foundation for understanding how the world they live in will change over time. The Interagency Council recognizes that arming the decision-makers of today with this same knowledge and understanding is important. By prioritizing the use of existing channels for continuing education for public officials and the professionals they rely on, state agencies will provide consistent data and information on how New Jersey's climate is changing, and how government action can help prepare communities and individuals for anticipated impacts. This training effort will include opportunities for staff at state agencies to also expand knowledge and skills to support implementation of this strategy and continue to advance future actions and programs to enhance climate resilience.

In addition to trainings and workshops, community science programs that engage the public in data collection offer an opportunity for residents and others to improve knowledge and skills while providing a critical public service. For example, watershed groups have been utilizing volunteers to collect information about stream quality for years to augment monitoring networks. This data does not replace the need for other monitoring techniques, but it has proven effective at enhancing stewardship. New Jersey could apply this approach to climate change and promote existing or build new community science opportunities to engage the public in observing trends and impacts related to climate change.

ACTIONS

4.2.1 Cultivate opportunities to engage youth populations on climate resilience education and solution development

4.2.2 Create trainings on climate change and adaptation measures for state and local leaders and staff

4.2.3 Promote workforce development and training opportunities through climate resilience initiatives

4.2.4 Expand community science opportunities to engage the public in observing trends and impacts related to climate change

While public investment in building skills for New Jerseys residents can support volunteer efforts, it can also address workforce development needs. There is a largely untapped opportunity to couple the need to address climate change with post-COVID economic recovery initiatives that increase the physical, economic, and social resilience of the most vulnerable communities in the state. Therefore, a workforce development program may provide resilience benefits to addressing hazards and other climate impacts by supporting infrastructure resilience, for example. This type of program emphasizes the importance of building the resilience of people and local economies, as well as the physical environment they rely on.

In addition to workforce development, agencies should promote opportunities to engage youth in developing resilience solutions and pathways for future actions. Recent years have seen a dramatic mobilization of youth action on climate change. Youth-led climate organizations have led demonstrations and called for aggressive state and national action to reduce emissions. This mobilization has been largely associated with the recognition that younger Americans will need to adapt to the world transformed by climate impacts.

Scientist Collecting Water Samples

Climate Change in K-12 Education

First Lady Tammy Murphy worked with DOE's Standards Review Team to incorporate climate change education into the NJ Learning Standards.

New Jersey is the first state in the country to incorporate climate change into its K-12 curriculum standards, taking a first step to prepare students to understand the implications of climate change. In 2019, the Department of Education adopted new standards that integrate climate change not simply through science curriculums, but also into lessons on social studies, health, and world languages. The climate change curriculum will also be presented as an equity issue of global importance. For example, students will grapple with how climate change affects public health and those who are most at-risk. Children in grades 9-12 will explore data for climate change trends and impacts, as well as research and propose engineering and policy solutions to address the challenges. This aggressive effort could serve as a model for other states seeking to increase awareness in youth about how climate change may affect their future. The standards will take effect in September 2021 or 2022, depending on the content area.

STRATEGY 4.3:
Develop a State-wide Climate Change Vulnerability Assessment

Jersey City, NJ

Over the past several years there have been a number of reports from private companies, academic institutions, and non-profit organizations that identify various aspects of New Jersey's vulnerabilities to the impacts of climate change. They reveal that dense patterns of development, low-lying lands, aging infrastructure, and an expansive coastline expose infrastructure, natural resources, and buildings to damage and disruption from various natural hazards. Reports from organizations such as Climate Central and the Union of Concerned Scientists help illustrate the vulnerability New Jersey faces under climate change. These external studies cannot satisfy the state's need for a full assessment of risk, and it is imperative that the state to have its own internal assessments and understanding of risk. Agencies will continue to advance efforts to modernize and upgrade data and analysis to reflect the most recent science and understanding.

To this end, the NJ Office of Emergency Management is working with Rutgers University to collect high resolution elevation data for coastal floodplains. This new and expansive dataset will provide more accurate information on building elevations, which in turn will significantly improve the state's ability to understand and estimate risk associated with coastal flood events. Coupled with data on building footprints and the building characteristics available from existing property tax data, the state will be positioned to advance an enhanced risk assessment that will amend the existing state hazard mitigation plan risk assessment and broaden the analysis of climate change.

ACTIONS

4.3.1 Collect and maintain elevation information for existing buildings and critical infrastructure

4.3.2 Collaborate across agencies and expertise to identify vulnerabilities for buildings, infrastructure, as well economic and social systems

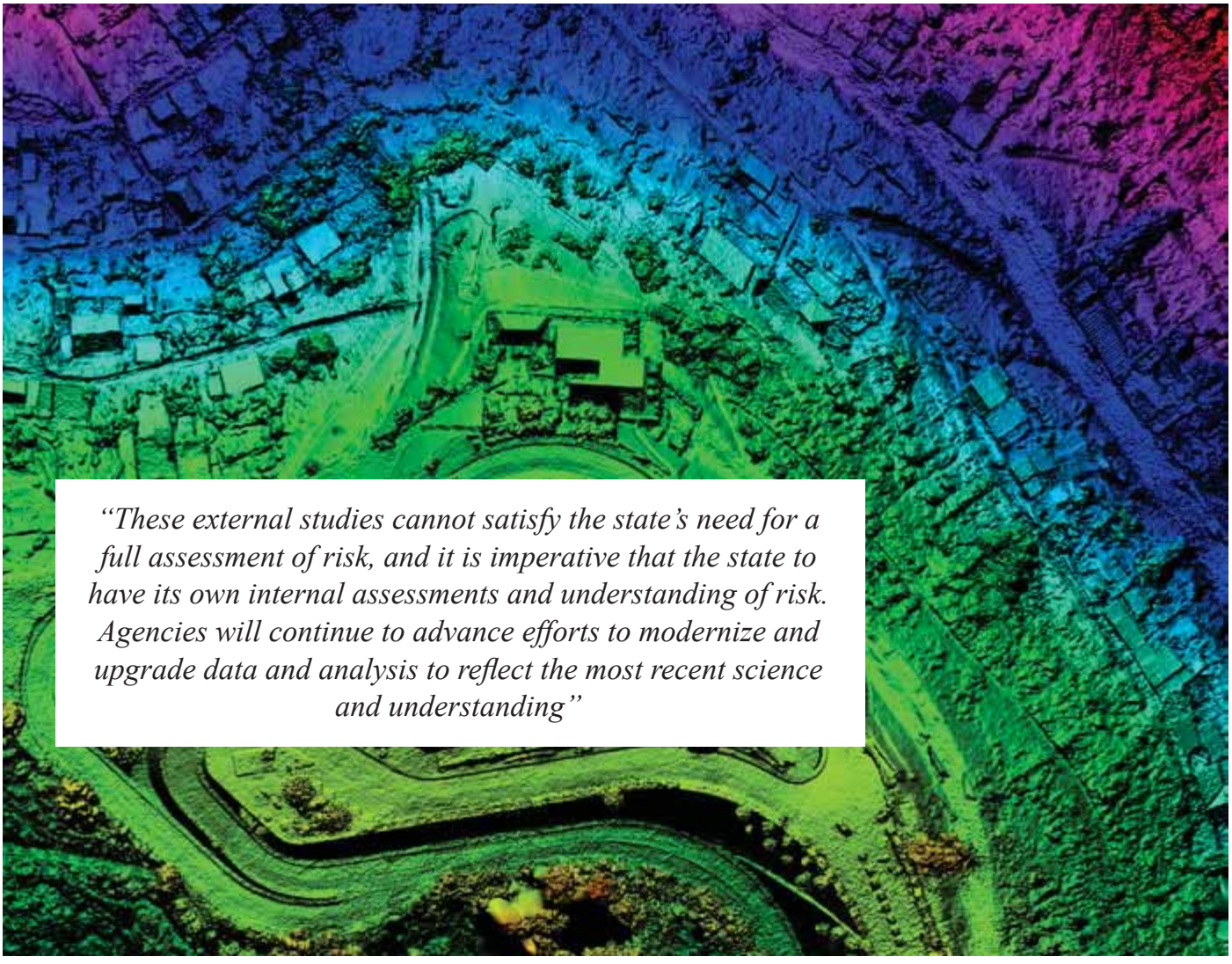
4.3.3 Identify specific risks for public health and social vulnerability

4.3.4 Systematically assess existing cultural resources and their vulnerability to climate change

4.3.5 Assess ecosystem health and vulnerability through a comprehensive statewide study

The enhanced risk assessment is just one of the efforts planned by agencies to look at the vulnerability of key state assets, economic drivers, and critical resources to climate change impacts. Other ongoing and planned agency efforts focus on public health, transportation infrastructure, historic and cultural resources, and ecosystem health and vulnerability. Agencies are continuously evaluating opportunities to analyze the impacts of climate change, in partnership with each other and external organizations. Future assessments should continue to build on existing studies and frameworks to maximize efficiencies. Other potential topics that have been raised as research questions are the role of insurance, reinsurance, and other market forces on adaptation and vulnerability within the state and how supply chains may be impacted by climate change. All future assessments will incorporate advancements in data on climate impacts, as well as improvements to topography, buildings, and infrastructure.

Rebuild by Design Outreach



"These external studies cannot satisfy the state's need for a full assessment of risk, and it is imperative that the state to have its own internal assessments and understanding of risk. Agencies will continue to advance efforts to modernize and upgrade data and analysis to reflect the most recent science and understanding"

STRATEGY 4.4: Build a Collaborative Research Agenda to Guide Future Climate Resilience Research

Hudson River

One of the policy challenges in responding to climate change is the evolving nature of risk and scientific understanding. Every day, across the nation, studies are being published that identify new methods for understanding the impacts of climate change on the natural and built environments, and public health. There are new plans, policies, and actions being discussed and tested at every level of government from defense agencies and transportation agencies to education departments. Increasing resilience to the evolving threat of climate change requires a dynamic policy response and constant engagement with the underlying science and research.

To ensure the state's response to climate change is based on sound scientific, state agencies should prioritize resources that support the advancement of research. Some ways to meet this need is through development of a collaborative research agenda, establishment of a standing grant program, sufficient funding to support existing monitoring networks, and updates to the *NJ Scientific Report on Climate Change*. Collectively, these actions will help fill any research gaps and refine the science and data that the state already has. For example, the *Scientific Report on Climate Change* identified gaps in existing research, two of which were projections for how rainfall patterns are shifting and the impacts to public health in the state. Through a collaborative effort across DEP and the Department of Transportation (DOT), there are two ongoing projects to advance research on precipitation projections and storm events to fill those gaps. Both projects will provide new insight on how shifting rainfall patterns affect

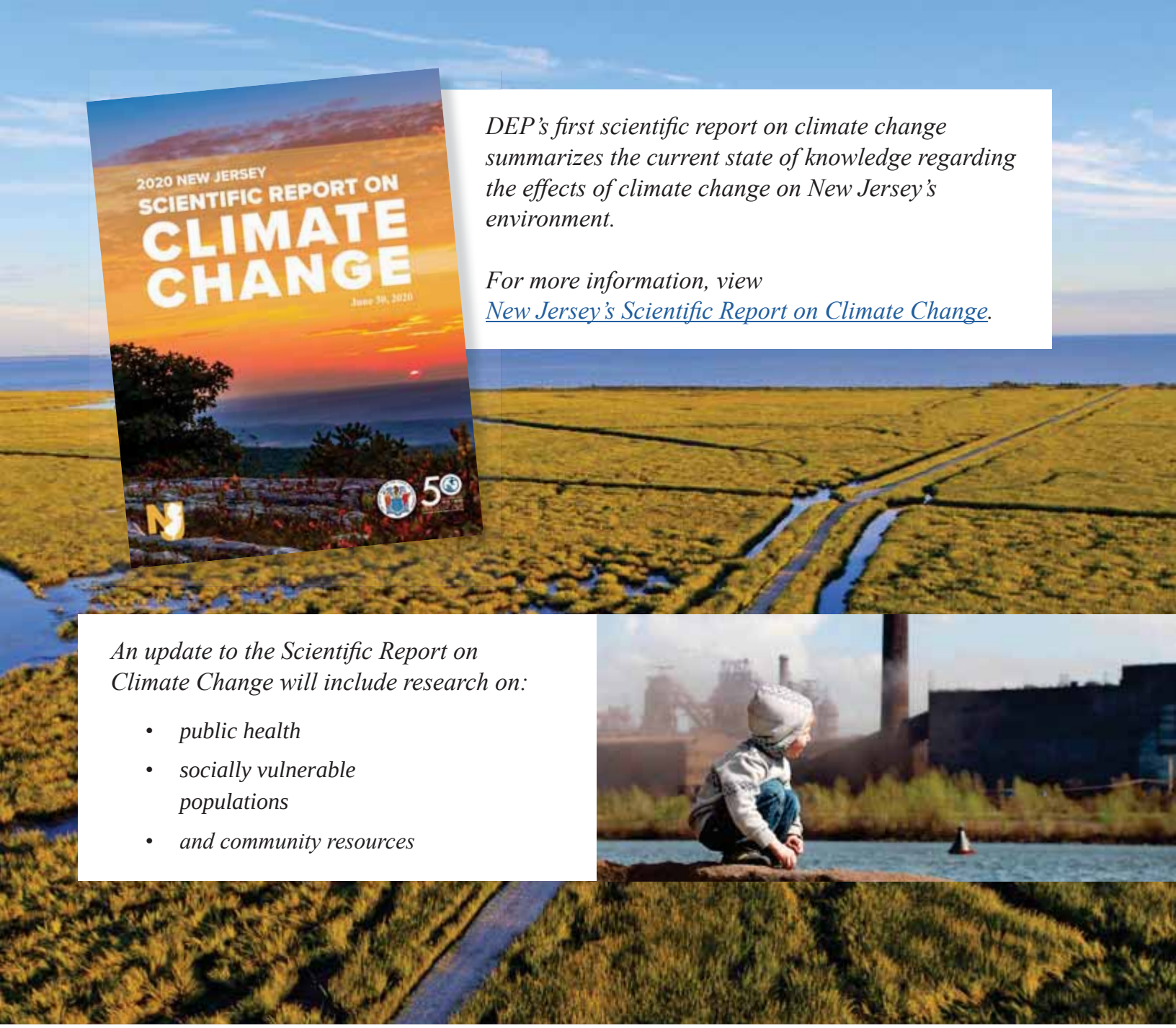
ACTIONS

4.4.1 Update the NJ Scientific Report on Climate Change to include research on public health, socially vulnerable populations, and community resources

4.4.2 Build a collaborative climate change research agenda to guide future research efforts across state agencies, federal agencies, universities/colleges, and other organizations

4.4.3 Establish a standing grant program to fund priority research needs

4.4.4 Support and enhance monitoring of environmental and climate indicators



DEP's first scientific report on climate change summarizes the current state of knowledge regarding the effects of climate change on New Jersey's environment.

For more information, view New Jersey's Scientific Report on Climate Change.

An update to the Scientific Report on Climate Change will include research on:

- *public health*
- *socially vulnerable populations*
- *and community resources*

Delaware Bay, NJ

flooding. This information will be critical to updating stormwater management practices and policy, as well as identifying priorities to reduce impacts of flooding to infrastructure and buildings in inland areas. DOT is working closely with Rutgers and DEP to understand the exposure to future inland flooding and drainage issues and integrate that knowledge into their long-range and capital planning efforts. The results of these initiatives will likely be available in 2021 to inform state, regional, and local actions.

In addition to the work on the data gaps related to precipitation, DEP, in close coordination with the Department of Health, is working to address the gap in research related to public health impacts in the *NJ Scientific Report on Climate Change*. In 2021, there will be an addendum to the 2020 report that includes information on climate change as it relates to impacts on public health from extreme weather. It will also include information on the secondary affects that harm public health including diminished air quality and infectious disease transmission, as well as the negative impacts on mental health, and the equity implications of the populations most affected by these impacts.

These examples of identified gaps, as well as others, underscore the importance of coordination in addressing scientific information and research needs as they cut across

agency mandates. Collaboration in addressing the gaps encourages consistency across agencies and leverages scarce resources more efficiently. In recognition of the value of collaboration, agencies expressed wide support for building a broad research agenda that will help focus and leverage scarce resources to meet diverse needs for more science and information. This will be an immediate priority for agencies on the Interagency Council to work together and with partners in federal agencies, academic institutions, and other organizations to identify critical future priorities for research in various natural and social science fields. Agencies, in cooperation with colleges and universities and other organizations in the state, will identify critical gaps in climate resilience research. This research agenda will guide the next iteration of the NJ Scientific Report on Climate Change, as well as the subsequent evaluations of this report.

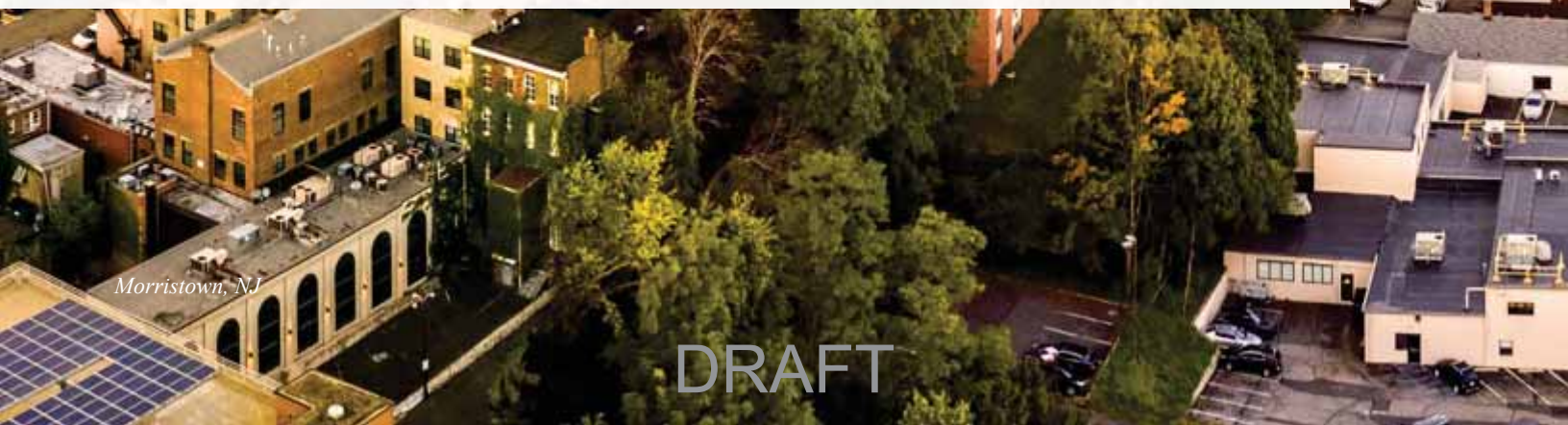
While this strategy calls for enhancements to existing research and data, these efforts should not be executed in a manner that compromises support for existing monitoring programs. New Jersey's programs for air, surface water, and groundwater, as well as tracking programs for other environmental and public health indicators, provide critical baseline data that informs policy and regulatory actions. Given the likelihood for climate change to exacerbate the very concerns that drove the installation of these monitoring programs, resilience efforts necessitate continued support for these programs to provide necessary data to understand trends. No action in this strategy should be perceived as undercutting the extensive and important data collection efforts that currently exist across state, regional, local, and non-governmental entities.

Overall, the state's support for the development and expansion of science will. The Interagency Council, as part of its efforts to identify and leverage funding, should evaluate if agencies are maximizing existing federal funding opportunities for research. If the state is unable to secure sufficient federal funding to support necessary research, New Jersey should consider opportunities for state funding. For example, California passed legislation in 2015 to develop a research program on atmospheric rivers because of their specific impacts on the state's economy and resources. Having a continuous funding stream has allowed continuity of research for this critical issue.

"DOT is working closely with Rutgers and DEP to understand the exposure to future inland flooding and drainage issues and integrate that knowledge into their long-range and capital planning efforts."

NJ FloodMapper, Photo Courtesy of Rutgers University

"Over the past several years identifying New Jersey's dense patterns of development, low-lying lands, aging infrastructure, and an expansive coastline expose infrastructure, natural resources, and buildings to damage and disruption from various natural hazards."



Morristown, NJ

PRIORITY 4 NOTES:

[1] Koning, A., C. Zukin, W. Young, and K. Morgan. 2019. Climate Change Attitudes in Society. A Collaboration: Eagleton Center for Public Interest Polling/ Rutgers-Eagleton Poll and New Jersey Climate Change Alliance. http://eac.rutgers.edu/wp-content/uploads/Eagleton-NJCCA-NJ-Climate-Poll-report_04-25-19.pdf

[2] Ibid

[3] Turner, E., and L. Raine. 2020. News in the Numbers. Most Americans Rely on Their Own Research to Make Big Decisions, and That Often Means Online Searches. Pew Research Center: Fact Tank. https://www.pewresearch.org/fact-tank/2020/03/05/most-americans-rely-on-their-own-research-to-make-big-decisions-and-that-often-means-online-searches/

PRIORITY 5:

PROMOTE CLIMATE-INFORMED INVESTMENTS AND INNOVATIVE FINANCING

INTRODUCTION

No climate resilience strategy can be effective without the ability to implement it. The many actions described throughout the *Climate Change Resilience Strategy* will require significant public investment, whether through policy changes, infrastructure projects, or research studies. Executive Order 89 calls for this *Resilience Strategy* to "identify financing mechanisms, strategies, and opportunities for coordination to support climate resilience measures, mitigation, and adaptation."[1] Accordingly, it is not the aim of this strategy to identify funding sources for particular resilience projects. Here, we must identify approaches and opportunities to incorporate climate impacts and equity into fiscal decisions and asset management, provide opportunities to attract private capital to resilience, and identify mechanisms to reduce public fiscal risk. The strategies in this section recognize the fiduciary responsibility of government to use public funds prudently. As such, they seek to overcome barriers to climate resilience from a fiscal perspective, such as uncertainty, high capital costs, and competing needs for limited funding.

While ensuring resilience carries significant costs, the avoidance of resilience costs carries far greater financial risks to people, businesses, and governments.[2] In contrast, investments in hazard mitigation and resilience provide large returns on investments. For example, every $1 spent on mitigation actions results in up to $6 of total savings.[3] Realizing both that these benefit-cost ratios highly favor action, and that climate change may add risk to their operations, many private companies have begun integrating climate change into their decision-making. Governments around the world are similarly moving toward integration of climate change into financial planning and decision-making.[4]

Red Bank, NJ


Historic Red Mill, Clinton NJ

STRATEGIES:

5.1 Integrate Climate Change into Existing State Investments and Funding Decisions

5.2 Expand the Availability of Financing for Resilience Investments from Public and Private Sources

5.3 Ensure Equity and Transparency in Resilience Investments

STRATEGY 5.1: Integrate Climate Change into Existing State Investments and Funding Decisions

ACTIONS

5.1.1 Incorporate climate risk analysis into existing state asset management, capital funding, and grant programs through updated evaluation, prioritization, and cost-benefit criteria

5.1.2 Expand low-cost public finance options dedicated for resilience projects through new and existing programs

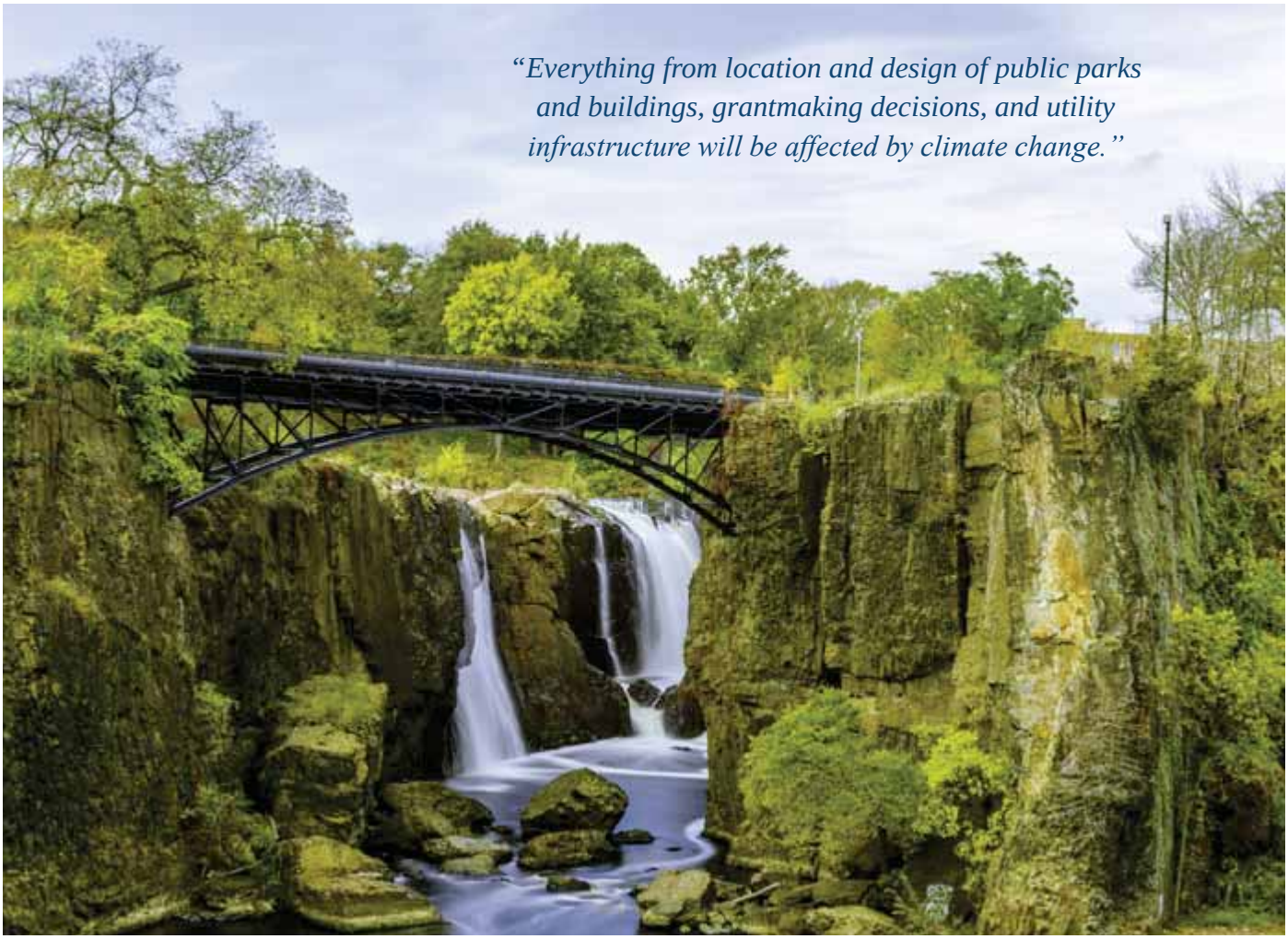
5.1.3 Prioritize investments that maximize co-benefits of greenhouse gas mitigation and resilience

5.1.4 Measure the ecological and social benefits of state investments, in addition to economic benefits, to aid in climate-informed decision making

Bayonne Bridge, NJ

Building resilience to climate change entails more than simply protecting existing assets against adverse impacts like sea-level rise, chronic flooding, and increased storm intensity; climate change must be accounted for in every aspect of government business. In relation to financial operations, climate change impacts pose significant risks to the long-term viability of state assets, be they roads and bridges, public health, or the tax base. New Jersey must invest public dollars into projects that will serve the long-term resilience of communities, especially the state's most vulnerable communities. Equally important is the public's trust that the State uses taxpayer funds wisely.

Climate change not only creates a new category of expense, it also has the potential to create significant risks for the State's current and future investments and assets. Whether directly climate-related or not, nearly everything the State spends money on will be impacted by climate change. Everything from location and design of public parks and buildings, grantmaking decisions, and utility infrastructure will be affected by climate change. Therefore, state agencies must incorporate climate risk analysis into their asset management, capital funding, and grant programs. In other words, New Jersey must ensure that it is making resilient investments. This can be achieved through multiple pathways, such as updating evaluation, prioritization, and cost-benefit criteria to include a climate lens. That added lens should also include an analysis of the ecological and social impacts



Paterson Great Falls, NJ

of the proposed investment. As discussed in Priority 2, healthy ecosystems play a strong role in supporting the overall resilience of New Jersey. Incorporating climate change risk into financial decision making will add an additional layer to that analysis, rather than supersede other criteria. In this way, the State can use the best-available science to make informed decisions and protect valuable public dollars.

New Jersey can also help ensure fiscal health by orienting its future spending to build resilience. The State is already successful in providing low-cost public financing options to infrastructure projects across New Jersey. The New Jersey Infrastructure Bank, for example, has provided more than $7 billion in financing since 1987 to water-related projects alone. Access to affordable capital through programs like those at the Infrastructure Bank allows local and county entities to build resilience at a reasonable cost. Many of the types of projects the Infrastructure Bank already finances in the environmental and transportation sectors contribute to the state's overall resilience. New Jersey can build on that success by expanding these public finance options with dedicated funds for climate change resilience projects.

As has been demonstrated throughout this plan, there will be many types of resilience-related activities necessary in the coming years, both to prepare New Jersey for climate impacts and to reduce greenhouse gas emissions. The ability to confront both climate change impacts and reduce their root cause in a single investment will aid in differentiating between which publicly-funded projects should move forward. The Interagency Council recognizes the value in prioritizing those investments that offer climate change mitigation and enhanced ecological value in addition to resilience.

STRATEGY 5.2: Expand the Availability of Financing for Resilience Investments from Public and Private Sources

ACTIONS

5.2.1 Expand the use of private capital in financing public resilience with innovative mechanisms such as environmental impact investing and bond measures

5.2.2 Promote public-private partnerships to share fiscal risk and deliver cost-effective resilience solutions

5.2.3 Create pilot projects using innovative financing and contracting approaches, including Pay for Success or performance-based contracting

5.2.4 Leverage multiple funding sources across agencies and programs for resilience projects

Kearny Power Station, Jersey City, NJ

The scale of action needed to address climate impacts is unprecedented and calls for extraordinary efficiency in capital deployment. Through a blend of current initiatives and innovative approaches, New Jersey has many tools available to finance climate resilience actions of all kinds. Existing options through public banks, appropriations, and bond measures currently provide some funding, but are insufficient to meet the State's growing need. To cope with the reality that public funding alone will not be enough to confront climate change impacts, the state can look to new approaches to fund resilience. Concepts such as environmental impact bonds, outcomes-based financing, and dedicated resilience resources hold promise to serve as renewable funding options. It will be necessary to embrace innovative approaches and leverage multiple funding sources across agencies to finance interventions and equitably distribute economic burdens of climate change.

In several states, governments and financial institutions have developed innovative financial products and partnerships to deliver cost-effective public outcomes. In general, these approaches involve governments entering into public-private partnerships with the private sector and community groups to provide upfront funds and complete projects or services ranging from building a new school to reducing pollution in rivers. Governments are risk-averse by nature, and for good reason: they have a fiduciary responsibility to use public funds wisely. By leveraging

private investment, traditionally risk-averse institutions can transfer the fiscal risk of a new resilience project or initiative onto the private funders while both entities share the benefits. This has the added benefit that private companies can often deliver projects more quickly than government agencies because they do not have the bureaucratic constraints typically associated with government. Governments can further reduce their risk exposure through innovative contracting approaches in which payment is contingent upon meeting verified metrics, a system known as Pay for Success. These options allow more work to happen at a faster pace than is typical and allow governments to have more confidence in the success of their investments.

These innovative relationships are possible because there is a growing class of investors that seek social or environmental outcomes from their investments in addition to financial returns. The public gain from these relationships lies in the efficiencies in project delivery and availability of novel funding sources. In New Jersey, a similar combination of public and private funds will be essential to funding resilience actions throughout the state. The State will leverage its existing institutions and funding sources while also exploring emerging financing mechanisms to overcome the barriers to broad implementation of resilience actions. Rather than completely shifting to new ways of operating, the Interagency Council will seek to first explore the legal and administrative feasibility of using mechanisms like Pay for Success in targeted pilot projects to demonstrate their effectiveness and fully understand their place in New Jersey before using them broadly.

Innovative Financing Headlines

New Jersey stormwater law may spur resiliency bonds

- The Bond Buyer, March 27, 2019

Investors Embrace 'Catastrophe Bonds'

- The Wall Street Journal, April 23, 2014

How states can finance coastal resilience before the next disaster

- Enviromental Defence Fund, September 9, 2020

Wind Turbine, Atlantic City, NJ

Impact Investing

Environmental Impact Bonds are an outcomes-based financial instrument which tie financial returns to environmental improvements. In many ways, environmental impact bonds are a blending of Pay for Success contracting with bond investment. Private investors only receive a return on their investment if the project financed by the environmental impact bond is successful in achieving the predetermined outcome, which is evaluated by a third-party based on metrics detailed in the bond agreement. Environmental impact bonds can be structured so that additional financial returns are given if projects outperform expectations. As a result, not only is private capital used to finance public goods, but that capital is also obtained at low cost and low risk; fiscal risk is transferred to the investors. The District of Columbia's water utility issued the country's first environmental impact bond in 2016 to finance green infrastructure projects across its service area and provides a robust model for New Jersey. By offering higher returns for better outcomes, environmental impact bonds incentivize efficiency, innovation, and effectiveness. These characteristics make environmental impact bonds a possible mechanism for financing resilience projects in New Jersey.

STRATEGY 5.3:
Ensure Equity and Transparency in Resilience Investments

ACTIONS

5.3.1 Update funding decision criteria to prioritize protection of underserved populations with perspectives and feedback from equity leaders

5.3.2 Evaluate opportunities to provide financial support for resilience investments to low-income residents

5.3.3 Publish resilience funding allocations on the New Jersey Transparency Center website[5]

Newark, NJ

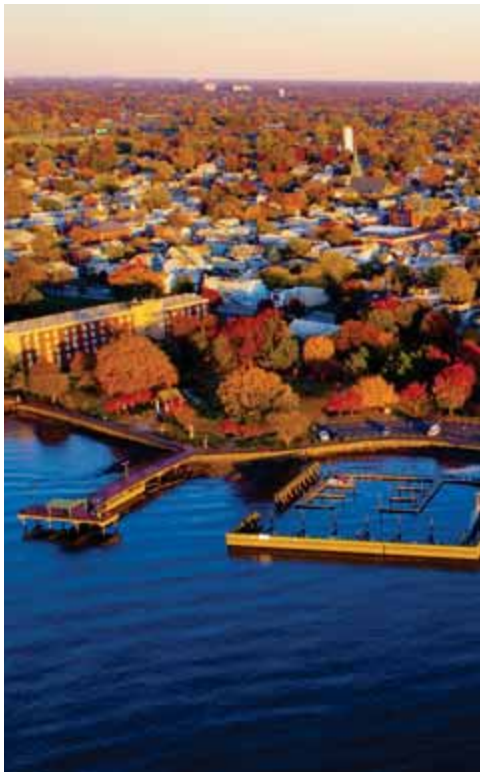
As a function of historic and structural racial, social, economic, and environmental injustice, already underserved communities will experience disproportionate adverse impacts of climate change. To ensure that resilience measures fully account for and are responsive to the needs of underserved communities, the Interagency Council will seek out community leaders for their perspectives on how to best incorporate and prioritize the needs of underserved populations in their work. In addition to community leaders, the Interagency Council on Climate Resilience will work in close collaboration with the Interagency Council on Environmental Justice and the DEP's Environmental Justice Advisory Council.

Through a continuing commitment to equity and justice, state agencies can work to address underlying inequities that lend to disproportionate climate vulnerability, and prioritize the resilience needs of underserved communities in fiscal decision-making, among other areas. Thus, the Interagency Council will actively analyze equity and social vulnerability

in decisions on where and how state resilience funding is invested as part of its larger coordination and planning efforts.

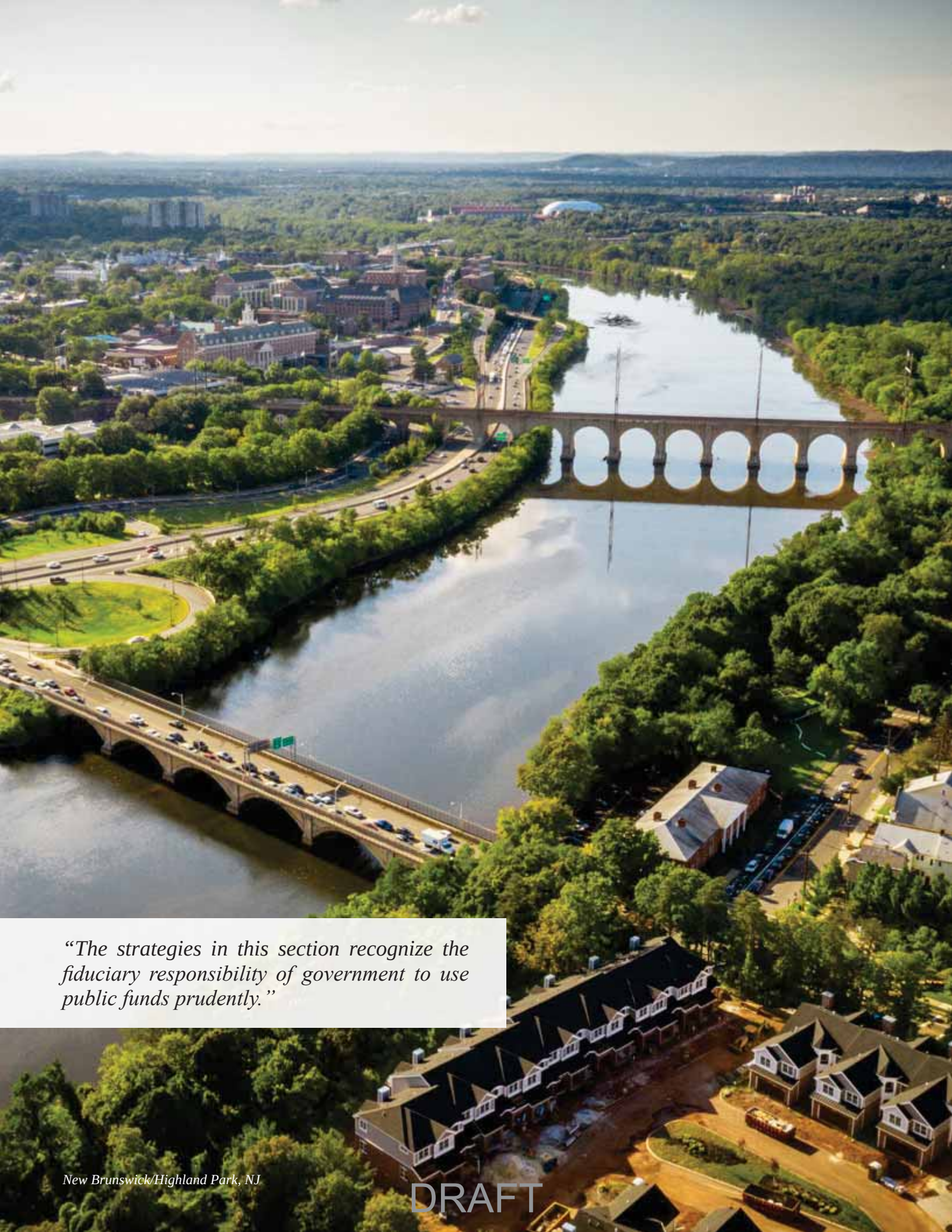
The Interagency Council recognizes that integrating equity into decision-making may not be enough to support increased resilience in low-income communities. While making New Jersey's communities more resilient to climate change impacts through home elevations or floodproofing will result in cost savings from avoided losses and decreased insurance premiums, these projects require significant initial capital from home and business owners. Low-income communities may be unable to shoulder such investments, leaving them more vulnerable. To address such inequities, the Interagency Council will explore financial assistance opportunities, including subsidies, for low-income community resilience projects. These public investments will reduce New Jersey's overall vulnerability to climate impacts, providing net benefits to taxpayers and the state as a whole.

The Murphy Administration is committed to equity and transparency in government spending. The Interagency Council will uphold that commitment by publishing resilience funding data online. With publicly available information regarding resilience investments, New Jersey residents can be confident that the State is following through on its commitments to equity and transparency.



City of Gloucester, NJ

Jersey City, NJ



"The strategies in this section recognize the fiduciary responsibility of government to use public funds prudently."

New Brunswick/Highland Park, NJ

PRIORITY 5 NOTES:

[1] Executive Order 89, 51 N.J.R. 1707(a). 2019. https://nj.gov/infobank/eo/056murphy/pdf/EO-89.pdf

[2] Ruth, M., D. Coelho, and D. Karetnikov. 2007. The US economic impacts of climate change and the costs of inaction: A Review and Assessment by the Center for Integrative Environmental Research (CIER) at the University of Maryland. Pages 5-9. https://static1.squarespace.com/static/546d61b5e4b049f0b10b95c5/t/5500a26ae4b04ab48cb1ed85/1426104938597US+Economic+Impacts+of+Climate+Change+and+the+Costs+of+Inaction.pdf

[3] Multihazard Mitigation Council. 2019. Natural Hazard Mitigation Saves: 2019 Report. National Institute of Building Sciences: Washington, DC.

[4] Secretary Janet Yellen. 2021. Addressing the Threat of Climate Change, Remarks to the Coalition of Finance Ministers for Climate Action. https://home.treasury.gov/news/press-releases/jy0104

[5] https://www.nj.gov/transparency/

PRIORITY 6:

COASTAL RESILIENCE PLAN

Introduction

The coastal areas of New Jersey provide immeasurable value as places of residence, tourist destinations, cultural and historic assets, ecological resources, and economic centers within the state. While climate change will impact all of New Jersey, the challenges are especially acute in the diverse areas of the coastal zone. In addition to the climate impacts seen statewide, the threats of sea-level rise and increasing coastal storms are making coastal communities more vulnerable, and the response more complex. Over time, how we respond and adapt to climate change will necessarily change the look and feel of New Jersey's coastal zone, but what will not change, is the coastal zone's importance to New Jersey's culture, economy, and character. The *Coastal Resilience Plan* represents early steps of a long-term strategy for climate change resilience and adaptation.

Hoboken, NJ


Point Pleasant, NJ

STRATEGIES:

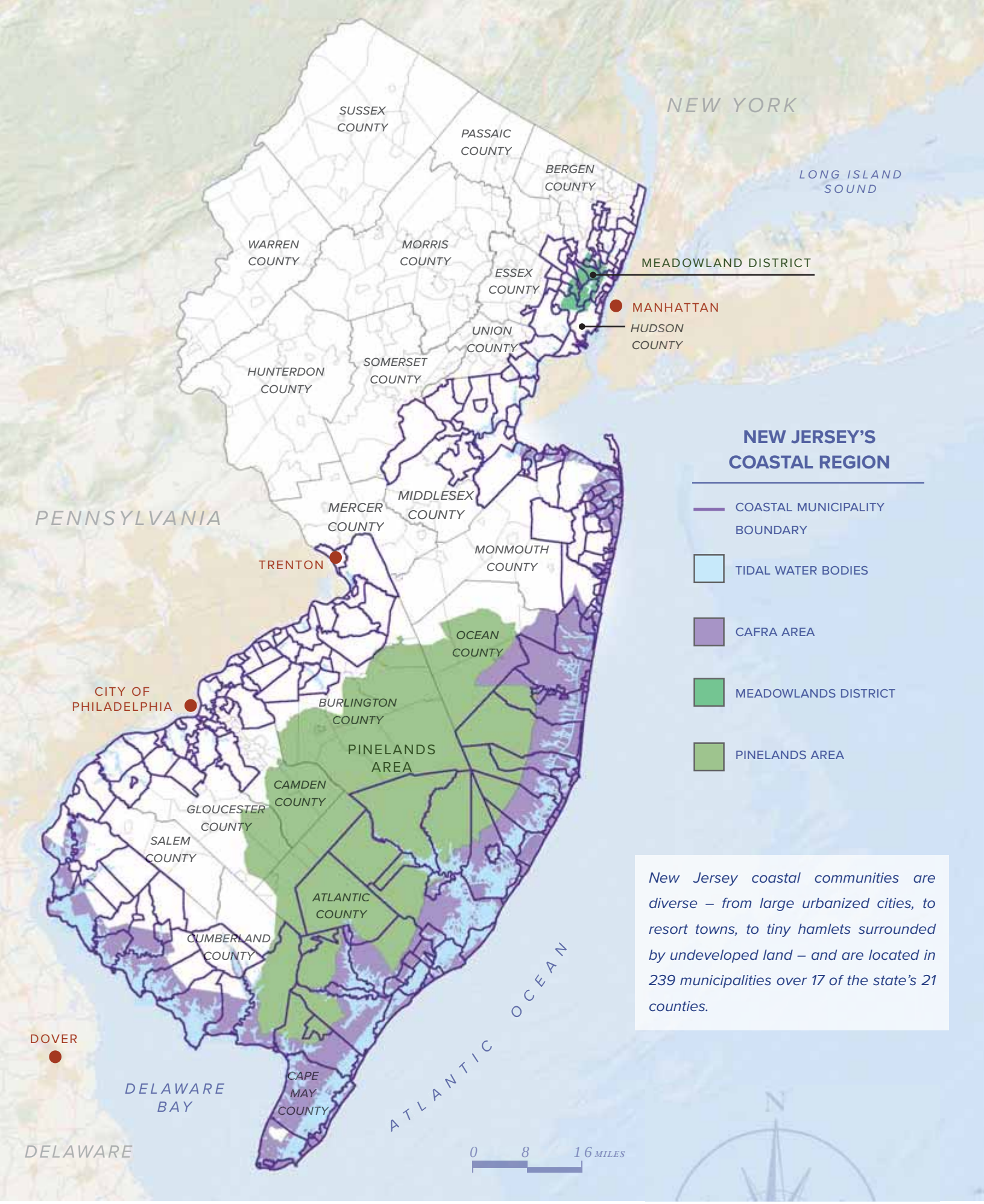
- **6.1 Incentivize and Support Community Resilience Planning**
- **6.2 Update Coastal Management Regulations and Policies to Reflect Sea-Level Rise and Other Climate Change Projections**
- **6.3 Sustain and Strengthen Tidal Marshes to Provide Ecological and Community Resilience**
- **6.4 Manage Shoreline Stabilization with Nature-based Features**
- **6.5 Manage Coastal Beaches and Dunes to Reduce Erosion and Storm Damage**
- **6.6 Reduce Flood Risk to Existing Buildings and Infrastructure**
- **6.7 Make Smarter and More Coordinated Investments in Coastal Resilience**
- **6.8 Share Financial Responsibility for Resilience**
- **6.9 Support and Incentivize Movement to Safer Areas**

The Shore and More

New Jersey's coastal zone is much more than the Shore. With 1,800 miles of tidal coastline, including the Raritan Bay, Atlantic oceanfront, and the Delaware Bay and Delaware River, New Jersey's coastline encompasses many types of waterfronts and communities. The coastal zone is comprised of 239 municipalities, located in 17 of the state's 21 counties, that include tidally flowed waters and/or are located within the Coastal Area Facility Review Act (CAFRA) boundary. New Jersey's coastal communities are diverse – from large urbanized cities like Newark, to resort towns like those on Long Beach Island, to urbanized coastal centers like Atlantic City, to tiny hamlets and working waterfronts on the Delaware Bay, and industrial towns like Camden along the Delaware River up to the state capital. The coastal zone is home to nearly 7 million year-round residents (80% of the state's population),[1] the largest container port on the east coast, the Hudson River Waterfront Walkway, internationally known cultural attractions, multiple military facilities, and major new infrastructure in support of New Jersey's burgeoning offshore wind industry.

The diversity of the coastal zone is reflected by the varied and abundant natural resources that are key to New Jersey's economy, character, and quality of life. The state's coastal ecosystems are among the most abundant and critical in the northeast United States and include tidal wetlands, an expansive barrier island beach and dune system, tidal flats, and coastal forest and shrublands. The state's more than 200,000 acres of tidal wetlands span most of the Delaware River and Bay, the Atlantic Coast behind the barrier islands, along the Raritan River, and up into the Meadowlands near New York City.[2] This large expanse provides habitat to birds, fish, horseshoe crabs, and other marine life. Additionally, these habitats are breeding grounds for many abundant species, including some that are rare in other areas of the world.[3] The shores of the Delaware Bay are particularly ideal for the largest breeding population of horseshoe crabs in the world. In turn, migratory birds, such as the Red Knot, rely on New Jersey's shore for survival. In total, the coastal area attracts over 1.5 million migratory shorebirds each year. These are just a few examples of the importance of New Jersey's coastal ecosystems.

The coastal zone is home to the largest container port on the east coast.



NEW JERSEY'S COASTAL REGION

- COASTAL MUNICIPALITY BOUNDARY
- TIDAL WATER BODIES
- CAFRA AREA
- MEADOWLANDS DISTRICT
- PINELANDS AREA

New Jersey coastal communities are diverse – from large urbanized cities, to resort towns, to tiny hamlets surrounded by undeveloped land – and are located in 239 municipalities over 17 of the state's 21 counties.

"The shores of the Delaware Bay are particularly ideal for the largest breeding population of horseshoe crabs in the world."

In turn, thousands of people travel to the coast for opportunities to fish, paddle, and view wildlife. It is estimated that for Cape May county alone, birding accounts for $313 million in consumer spending.[4] New Jersey's commercial fishing industry harvests over 50 different species of finfish and shellfish annually, boasting world-class recreational fishing, clamming, and crabbing. In 2016, New Jersey ranked third in the country, behind only Florida and North Carolina for the number of recreational saltwater fishing trips.[2] Additionally, the coastal zone is critical to a $50 billion maritime industry[5] which includes ports and terminals, cargo movement, boat manufacturing and sales, ferry operations, government services, marine trade, recreational and commercial boating, and maritime environmental resources. As home to the Port of New York and New Jersey, over $200 billion[6] in cargo moves through the Port (estimates from 2016) each year. Counties in the coastal zone are estimated to contribute $400 billion in annual economic output,[7] $22 billion from tourism alone,[8] which is more than half of total tourism dollars. In 2017, leisure, hospitality, and retail accounted for approximately $50 billion of the state's gross operating profit.[9] A 2008 study estimated that the average population during peak summer season increases by 107% to 908,000.[10]

These are just a few examples of what makes New Jersey's coast so special and makes it clear why businesses, tourists, and residents are drawn to the coast. However, uncoordinated development throughout the coastal zone has resulted in both dense development, frequently in at-risk low-lying areas, and sprawling development separated from critical infrastructure. These development patterns have negatively impacted fragile ecosystems through direct physical damages, fragmentation and loss of habitat and biodiversity. These same patterns of development has also put buildings, infrastructure, and people at risk and has resulted in loss of life and damage to property from coastal storms' erosion and flooding. Science strongly indicates that these issues will only be exacerbated by climate change in the coming decades.[11]

New Jersey's Coastal Zone

1,800 *miles of Tidal Coastline*

200,000 *acres of tidal wetlands*

80% *of New Jersey's year-round population lives within the Coastal Zone*

3rd *highest state in the country for the number of recreational saltwater fishing trips*

$200B+ *in cargo moves through the Port of New York and New Jersey each year*

The Existential Threat

Climate change is adversely affecting NJ and the risks are only increasing. The threats to the coastal zone are among the most severe. One of the most visual impacts of climate change in the coastal zone is increased flooding where the underlying driver of sea-level rise makes planning for future flooding in the coastal zone particularly challenging. Sea levels could rise approximately one to two feet by 2050, and increase two to five feet under a moderate emission scenario by the end of the century.[12] An increase in sea level will also mean that New Jersey's coastal areas have an increased vulnerability to higher storm surges from more intense coastal storms.[13] While not as likely to garner headlines as massive coastal storms, increased tidal nuisance flooding, or sunny day flooding, due to sea-level rise will be widespread, occurring twice each day with the high tide. Tidal flooding will occur more often over time and eventually cause permanent inundation in some areas.[4] Close to 3,600 buildings and structures are anticipated to either be impacted daily or permanently inundated with one foot of sea-level rise, and almost 11,000 with two feet of sea-level rise.

New Jersey's coastal ecosystems are equally at risk from sea-level rise. Coastal marshes provide invaluable habitats for fish, bird, and plant species, that if lost would result in dramatic declines in species health and biodiversity. These habitats are also critical to the state's physical resilience and are an important driver of the economy. New Jersey has already lost significant areas of coastal habitat and could lose 28 percent of its tidal salt marshes by 2050 with sea-level rise of one to two feet. That loss of habitat will have cascading negative impacts on multiple aspects of the state's way of life, including health and safety.

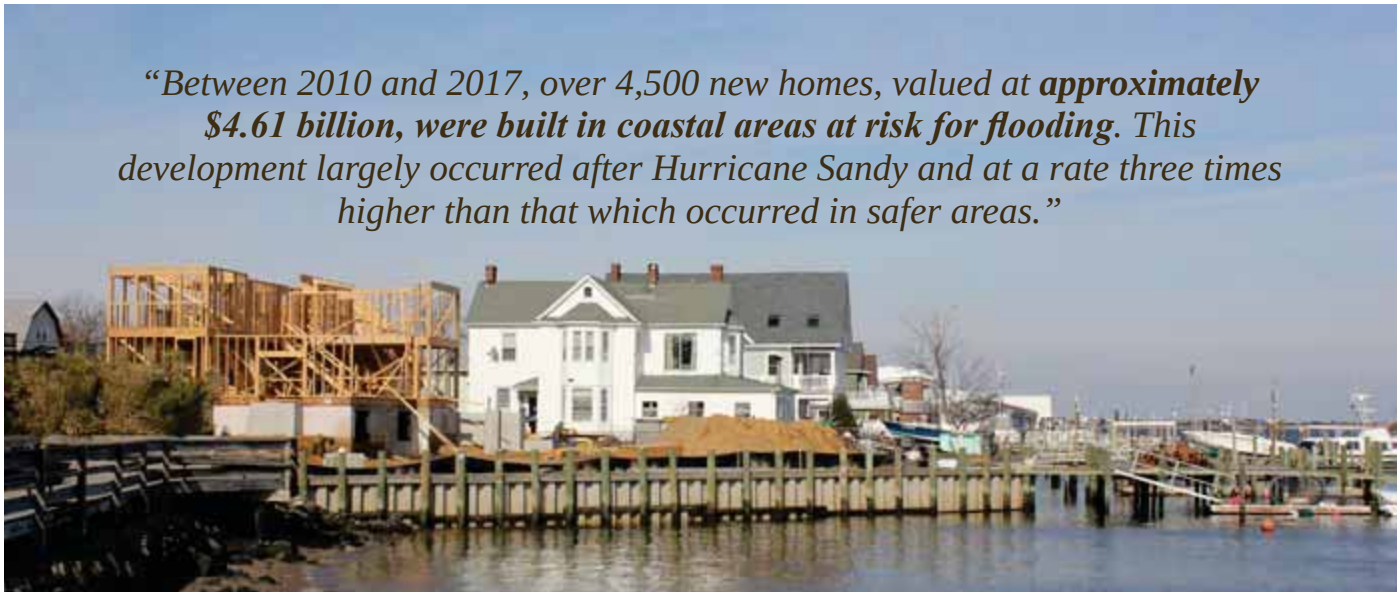
"...in the next 30 years, 62,000 homes in New Jersey are at risk to chronic flooding."

- 2018 Study by Union of Concerned Scientists

The economic dependence on the coast incentivizes the continued development and redevelopment in highly vulnerable areas. These choices become even riskier as the impacts of climate change increase. New Jersey has mitigated some risk of coastal disasters but the economic damage will increase exponentially over time.[5] A Union of Concerned Scientists (2018) study found that in the next 30 years, 62,000 homes in New Jersey are at risk to chronic flooding.[14i] Alarmingly, 15-20 percent of those homes were built after 2000, and 2,600 of them were built or rebuilt after the ravages of Hurricane Sandy.[15]

Even after thousands of homes, structures, and many utility systems were decimated by Hurricane Sandy, damaged areas were reconstructed in much the same way they existed previously in a rush to return to normal. However, decisions based on past events are

[i] The Union of Concerned Scientists study is based on sea-level rise projections of similar magnitude to the high end (<5% likelihood of occurring) of the range estimated in the 2019 Science and Technical Advisory Panel report for 2100 under a moderate emissions scenario.



Highlands, NJ

no longer a safe guide as the risk of future damage and destruction from flooding increases. As climate change impacts critical infrastructure, like bridges, power supply, and clean water, New Jersey must consider how it can maintain the systems that are vital to life. Much of the resilience response to Hurricane Sandy included raising homes and development of plans for flood reduction barriers like seawalls. While such efforts may be necessary actions in some locations, elevations, without more, do not necessarily ensure resilience. In most cases, the community infrastructure that services elevated structures remains unelevated and vulnerable; especially roads. Additionally, while flood reduction barriers may protect against significant events, they do not protect against the pervasive daily flooding that will be caused by sea-level rise.

As New Jersey continued to build new structures in areas at risk to current and future flooding, residents, visitors, and investors were put more at risk of personal and financial losses. Between 2010 and 2017, over 4,500 new homes, valued at approximately $4.61 billion, were built in coastal areas at risk for flooding.[16] This development largely occurred after Hurricane Sandy and at a rate three times higher than that which occurred in safer areas.[17] This behavior has significant negative impacts on the health, safety, and welfare of NJ citizens, and puts personal and public investment at risk. The same study determined that four of New Jersey's coastal counties and four cities were among the top 10 nationally of homes built in risky areas.[18]

Management of New Jersey's coastal zone must include adaptation to the increasing threat of coastal hazards. Not only is tourism, the main economic driver of the coastal area, at risk but the evacuation routes, hospitals, schools, military bases, homes, and commercial districts that serve as the foundation of communities, are also threatened. It will not be financially or structurally feasible to build protection structures in every vulnerable area of the coastal zone. New Jersey needs to change the way we assess, acknowledge, and account for risk along the coast and plan for a more resilient future. By ignoring the need to make changes now, we only increase the threat New Jersey will face in the future.

Donald J. Henderson Memorial Bridge, NJ

Coastal Management


Maurice River, NJ

The Coastal Zone Management Act of 1972 authorized the National Coastal Zone Management Program, which is a voluntary partnership between the federal government and U.S. coastal and Great Lakes states and territories. The purpose of the program is to balance the protection of coastal resources with the many competing uses of coastal areas. The Coastal Zone Management Act encourages coastal states to be proactive in managing coastal resources for their benefit and the benefit of the nation. The program is currently administered by the National Oceanic and Atmospheric Administration (NOAA). New Jersey's Coastal Management Program received federal approval in 1978. Through the Costal Management Program, the New Jersey Department of Environmental Protection (DEP) manages the state's diverse coastal zone, which encompasses tidal and non-tidal waters, waterfronts, and inland areas.[19]

To effectively manage the coastal zone, the Coastal Management Program is comprised of a network of offices within the DEP that share responsibility for managing New Jersey's coastal uses and resources. These activities include wetlands, coastal hazards, public access, marine debris, cumulative and secondary impacts, special area management plans, ocean and Great Lakes resources, energy and government facility siting, aquaculture, and education and outreach.

State agencies regulate and influence development, primarily through the DEP, to protect ecosystems and development from harm. The DEP accomplishes this task by bringing together the regulatory authorities of the Coastal Area Facility Review Act, the Wetlands Act of 1970, Waterfront

Coastal Goals

1. Healthy coastal ecosystems.
2. Effective management of ocean and estuarine resources.
3. Meaningful public access to and use of tidal waterways and their shores.
4. Sustained and revitalized water-dependent uses.
5. Coastal open space.
6. Safe, healthy and well-planned coastal communities and regions.
7. Coordinated coastal decision-making, comprehensive planning and research.
8. Coordinated public education and outreach.

The addition of coastal goals addressing climate change and equity are being considered as part of the New Jersey Protecting Against Climate Threats (PACT) rulemaking process discussed further in Priority 1 and Strategy 6.2.

Development Law, Tidelands Act, Public Trust Doctrine, Beaches and Harbors Bond Act, the federal Coastal Zone Management Act, and integrating them through the New Jersey's Coastal Zone Management Rules to guide implementation of New Jersey's Coastal Management Program. The collective legislative and executive branch actions between 1970 and 1980 led to the current regulatory framework and action to regulate development and balance economic growth with the protection of environmental resources, public health, and public safety. However, in the face of climate change this balance is threatened by increased pressure of conflicting priorities - protect existing development, enable opportunities for growth, and preserve the critical ecosystems that flourish within New Jersey's coastal area.

The Plan

As a means to address these issues, Executive Order 89 directed the Interagency Council on Climate Resilience (Interagency Council) to develop a *Coastal Resilience Plan* "that recommends a specific long-term strategy for climate change resilience and adaptation in the coastal areas of the State" as part of the broader *Climate Change Resilience Strategy*. That directive recognizes that nowhere are environmental resources and economic vitality more inextricably linked than in the coastal region and the criticality to plan for the increased risks resulting from climate change.

The *Coastal Resilience Plan* focuses on strategies to protect, restore, and responsibly develop the diverse coastal communities and resources in light of the current and future impacts of climate change. To date, the protection of the coastal zone has been based in part on the *1981 Shore Protection Master Plan*. The *Coastal Resilience Plan* includes the actions necessary to build upon the master plan and outlines the policies, tools, and resources that serve as the initial steps of a statewide effort to increase the resilience of New Jersey's coastal zone in an equitable, sustainable, and economically viable manner. New Jersey's coastal area in the future may look and feel different than it does now, but through statewide efforts, this important area can remain an attractive place to live and recreate while continuing to drive the state's economy.

Developed by the Chief Resilience Officer with support from the Interagency Council, this first iteration of the *Coastal Resilience Plan* focuses on actions state agencies can take to improve the effectiveness, equitability, and sustainability of coastal resilience planning and projects. The *Coastal Resilience Plan* is a living document that will be updated as coastal resilience science, planning, and actions progress over time and will be the guiding document for how New Jersey manages protection of the coastal zone into the future.

Many of the climate change resilience issues facing New Jersey, including both climate impacts (temperature rise, air quality changes, etc.) and governance challenges (limited capacity and resources, multiple levels

Sandy Hook, NJ

of government, etc.), are shared by coastal and inland communities. To avoid duplication between the *Climate Change Resilience Strategy* and *Coastal Resilience Plan*, these statewide challenges are addressed in detail within the *Climate Change Resilience Strategy* and referenced within the *Coastal Resilience Plan* as needed. The *Coastal Resilience Plan* focuses on targeted strategies to address the unique coastal hazards of sea-level rise, tidal flooding, storm surge, and coastal erosion.

Cape May, NJ

Major Policies of the Coastal Resilience Plan

The following are significant policy statements that inform the strategies of the *Coastal Resilience Plan.*

1. Shore protection engineering will not be financially or structurally feasible in every vulnerable area of the coastal zone. The state will prioritize major flood protection investments to major population and economic centers, concentrations of critical infrastructure systems, or in areas with socially vulnerable populations.
2. The state will continue to invest in all types of coastal resilience strategies to protect and enhance state and community assets but will prioritize non-structural and natural and nature-based features except where technically infeasible.
3. The state will support the development of comprehensive, equitable, resilience plans in every coastal municipality.
4. The state will invest in the protection, restoration, and enhancement of its coastal ecosystems to support their ecological, recreational, and economic value.
5. The State will prepare for and facilitate the evolution of the coastal zone as populations move to safer areas, and limit investments that will hinder that purpose.

STRATEGY 6.1:
Incentivize and Support Community Resilience Planning

ACTIONS

6.1.1 Support all coastal counties and municipalities to develop resilience plans that address current and future coastal hazards

6.1.2 Provide guidance on use of sea-level rise projections

6.1.3 Require nature-based solutions in all coastal resilience planning

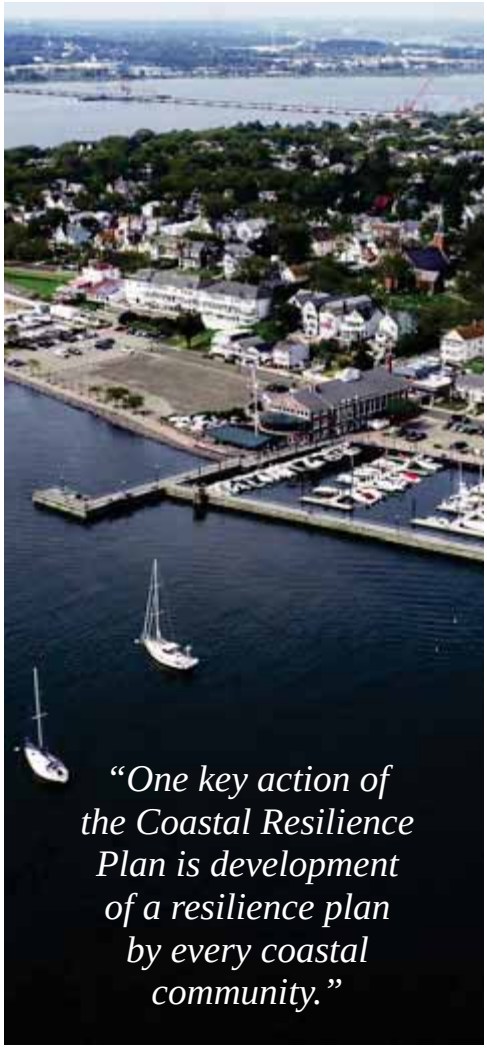
6.1.4 Address the needs of socially vulnerable populations in resilience planning

6.1.5 Integrate resilience into State Plan Endorsement coastal center designation

NJ FRAMES Open House, Middletown, NJ

Sea-level rise is causing more frequent flooding in coastal communities from increased precipitation and more intense storms, and daily high tides. All coastal communities share this threat of flooding, but the solutions needed to increase community resilience to coastal hazards will be unique to local aspects such as topography, development patterns, infrastructure, the heritage and culture of a town, and socioeconomic factors. This strategy includes actions state agencies will take to empower and incentivize coastal counties and municipalities to build resilience at the local level, regardless of capacity, size, location, or wealth. Increasing resilience across all of New Jersey's communities, not only to the increased risk of flooding but to all climate change impacts, can only be accomplished by significantly increasing capacity at the local level through state government leadership, guidance, and support.

As a home rule state, local government action is critical for effective coastal resilience, yet municipalities and counties often lack the technical and financial means to proactively prepare for and confront sea-level rise and other climate impacts. One key action of the *Coastal Resilience Plan* is development of a resilience plan by every coastal community. These plans should assess exposure to coastal hazards, including future flood events and tidal "nuisance" flooding, and identify resilience responses tailored to the unique character of the community. The resilience responses identified should include, and prioritize, the use of natural and nature-based features, consistent with other strategies. It is critical that these plans be developed now as most coastal resilience projects take many years to execute and land use planning takes significant time to transition. Local jurisdictions should also consider developing post-disaster plans and policies to ensure



Perth Amboy, NJ

that they "bounce forward" and not simply "build back" after an event. Furthermore, a recently enacted amendment to the Municipal Land Use Law requires a climate change-related hazard vulnerability assessment be included in municipal master plan updates. All of these plans must ensure the engagement of socially vulnerable populations during development and seek to specifically address identified needs in order to foster equitable community resilience and prevent additional inequality.

To support development of local resilience plans, existing planning programs should be expanded to provide additional resources and technical assistance. Several initiatives are currently underway that will provide some of the guidance and resources municipalities require to adequately address the critical need to plan and prepare for worsening climate change impacts. The DEP will expand its Resilient NJ program to provide additional support to local governments including local resilience planning guidance that addresses sea-level rise, funding opportunities, and the actions local governments can take to improve resilience. This expansion will include direct technical assistance provided through the New Jersey's Coastal Management Program's 2021-2025 Section 309 Assessment and Strategy for coastal hazards, which will develop a Regional Resilience Coordinator initiative. Additionally, the Office of Planning Advocacy will support municipal planning through the Plan Endorsement program, which has already incorporated requirements for resilience planning, climate mitigation, and equity as part of the updated Plan Endorsement Guidelines (October 2020).

Regardless of the technical assistance and guidance provided by state agencies, municipalities will require funding assistance to develop and implement local plans. New Jersey should consider providing a steady source of funding for a standing grant program to allow local jurisdictions to significantly advance their resilience planning.

New Jersey Fostering Regional Adaptation Through Municipal Economic Scenarios (NJ FRAMES)

The NJ FRAMES[20] project, also known as "Two Rivers, One Future," is a collaborative regional effort for the fifteen municipalities around the Navesink and Shrewsbury Rivers in coastal Monmouth County, New Jersey. The region partnered with the Coastal Management Program through DEP and NOAA, Rutgers University, and the Jacques Cousteau National Estuarine Research Reserve (JC NERR) to better understand and begin to address the future flood vulnerability in their communities. The project used comprehensive, regional planning to develop a regional action plan that addresses the challenges associated with climate adaptation for the communities on the frontlines of rising sea levels and increasing frequency of coastal storms and flooding. This was accomplished through comprehensive community and stakeholder engagement, regional risk and cost-benefit assessments, scenario planning, government coordination, and cutting-edge practices to plan for the long-term impacts of climate change.

The planning framework piloted in NJ FRAMES was developed by NOAA and informed development of DEP's Resilient NJ program.

STRATEGY 6.2: Update Coastal Management Regulations and Policies to Reflect Sea-Level Rise and Other Climate Change Projections

ACTIONS

6.2.1 Ensure development and redevelopment is informed by current and future coastal hazards

6.2.2 Establish sea-level rise zones for areas that will be subject to chronic inundation

6.2.3 Modify regulations to ensure flood risk reduction measures, including engineered dunes, do not promote development in vulnerable areas

6.2.4 Include ecological enhancement with shoreline protection projects

6.2.5 Protect public access in the event of structural solutions or changes to the waterfront

6.2.6 Designate a central decision-maker within the New Jersey Department of Law and Public Safety, Division of Law to guide all coastal management legal policies

Nuisance Flooding in Seaside Park, NJ

The Rhodium Group calculates that due to sea-level rise since 1980, there are 23,000 more homes and other buildings at risk from flooding, and 27,000 more buildings now likely to flood at least once per year. They also calculate that flood risk from hurricanes has also expanded with between 62,000 and 86,000 more homes and commercial properties that will possibly experience a hurricane during a 30-year mortgage.[1] The group further estimates that 33,000 to 58,000 more buildings in New Jersey will be frequently flooded[i] due to sea-level rise by mid-century.[ii] Further, Zillow predicts that 3,100 new homes will be built in the annual flood zone by 2050.[21]

These statistics demonstrate not only that there is a desire to live in coastal areas, but also the risk that comes along with that choice. The demand to develop and redevelop in New Jersey's coastal areas is not anticipated to diminish; people and livelihoods will continue to be in harm's way. To effectively address increasing climate risk and protect natural environments, life, and property, climate change considerations, including sea-level rise, must be incorporated into the regulations and policies that

[ii] The Rhodium Group utilized projections from the 2016 Science and Technical Advisory Panel report and potentially underestimates the impacts.

govern New Jersey's coastal area. Specifically, updates should be made to reflect the level of risk that will occur in the coastal zone.

New Jersey's regulations do not currently consider future coastal hazards when determining where and how development may occur. However, regulatory and policy changes could allow the state agencies the ability to ensure that the standards for protection against climate threats are commensurate with the risks now and into the foreseeable future. Additionally, regulations could allow the unique opportunity after destructive storms and flood events to implement flood mitigation and to rebuild under more protective standards and requirements.

State agencies will evaluate and update policies and regulations as necessary to plan for sea-level rise and more intense coastal storms to inform management of assets and project designs. For example, sea-level rise risk zones should be identified for areas that will be chronically inundated and discourage new development in these highly vulnerable locations. Additionally, state agencies should ensure that regulatory requirements for risk reduction measures do not inadvertently incentivize development in highly vulnerable locations. For example, development is prohibited on beaches. However, due to loophole in the definition of a beach, construction of an engineered dune provides an area landward of that dune where development would now be permitted. These are critical steps to protect New Jerseyans and the economy by ensuring that coastal communities are resilient. This type of regulatory and policy reform is well underway at the DEP which, in addition to being tasked with the protection of the natural environment through its regulations, is also responsible to protect against threats to life and property. In response to Governor Murphy's Executive Order 100, the DEP embarked on a targeted regulatory reform effort in 2020 to modernize its rules. Termed NJ Protecting Against Climate Threats - Resilient Environments and Landscapes (PACT-REAL), this effort will allow DEP's regulations to reflect climate risk and guide development and redevelopment in a manner that reflects coastal hazards today and in the future.

State agencies should consider setting a policy that all investments include a natural or nature-based component and the requirement to provide financial offsets if a natural or nature-based component is not feasible. For example, living shoreline elements can be incorporated into hard infrastructure like a seawall. The DEP will work to develop a policy through the Coastal Management Program to increase the use of natural and nature-based features when implementing hard shoreline stabilization projects, as discussed in more detail in Strategy 6.4.

When implementing resilience measures it is important to not lose sight of critical functions the coast provides, such as access to the shoreline and coastal ecosystems. Shorelines will inevitably be altered through construction of flood reduction projects and changes that will occur from sea-level rise. These changes have the potential to significantly impact both public access and ecosystem

NJ PACT: Protecting Against Climate Threats

NJ PACT[22] is a DEP effort to modernize New Jersey's environmental regulations to help Garden State residents, businesses, and communities reduce and respond to climate change.

As directed by Governor Murphy's Executive Order 100 (January 2020), the DEP is examining each of its regulatory schemes and programs to integrate climate change considerations. In two of its initial regulatory modernization efforts, the DEP will:

- Modernize air quality regulations through a series of **Climate Pollutant Reduction (CPR)** proposals – a first step toward achieving reductions called for by the Global Warming Response Act 80x50 Report, and consistent with the state's Energy Master Plan.

- Modernize environmental land use regulations through a series of **Resilient Environments and Landscapes (REAL)** proposals, that will help to protect people and property from the present and increasing threats of climate change, including sea-level rise and chronic inundation.

Allenhurst, NJ

health. The state has the duty, and in some cases is required by statute, to ensure these important coastal resources are protected. The DEP is specifically tasked through statute (New Jersey Senate Bill 1074, May 3, 2019) with promoting and protecting these resources through its policies and regulations. Through initiatives such as REAL and other regulatory reform efforts, the DEP must continue to develop requirements and policies that consider protection of equitable access to shorelines and the health of ecosystems in light of changing conditions. One way the DEP will specifically address public access is through the New Jersey Coastal Management Program's 2021-2025 Section 309 Assessment and Strategy for public access and will seek to facilitate the creation of meaningful public access for all through a statewide assessment of public access deficits and opportunities to guide public access development while ensuring the protection of ecological resources. Action must be taken to ensure both of these vital aspects that contribute to the character of the coastal zone, are protected. As such, all shoreline protection projects should incorporate public access and ecosystem enhancement into planning and design.

As climate change further impacts the coastal zone and state agencies undertake new coastal resilience policies, regulations, and projects to confront sea-level rise and flooding, they will face increasing legal question and challenges. To assist in making consistent and legally sound decisions on coastal management issues, the Department Law and Public Safety should consider establishing a coastal-focused unit.

"33,000 to 58,000 more buildings in New Jersey will be frequently flooded due to sea-level rise by mid-century."

- The Rhodium Group

Hoboken, NJ

STRATEGY 6.3:
Sustain and Strengthen Tidal Marshes to Provide Ecological and Community Resilience

Heislerville, NJ

New Jersey's coastal areas are comprised of many types of ecosystems, each critical to the character and vitality of the state. Wetlands, marshes, coastal forests, estuaries, and maritime dunes each provide specific ecosystem services and work together to provide resilience to New Jersey's shoreline through habitat health, increased protection, and economic opportunities. For example, tidal wetlands improve water quality by filtering coastal waters making them prime fishing and swimming areas. A loss of marsh would result in a sharp decline in crab, fish, and bird populations leading to a collapse of the recreational and commercial fishing industries and ecotourism. In total, studies have found that tidal wetlands provide more than $1.24 billion per year in ecosystem services.[23]

Coastal habitats protect approximately 90 percent of New Jersey's coastline from exposure to coastal hazards, like sea-level rise and storm surge.[24] These natural systems store and filter floodwaters, weaken the force of waves, and absorb some of the destructive impacts of storm surges before they reach homes and infrastructure. Without a marsh or forest buffer, back bay communities would be impacted by daily wave energy and increasingly battered by storm surge. One study found that communities located behind intact marshes had 20 percent less flood damage than those communities in which the marsh buffer had been lost.[25] These damage reduction benefits equal large financial savings for New Jersey residents. A 2016 study estimated that coastal marshes saved New Jersey more than $625 million during Hurricane Sandy.[26] These are examples of just some of the benefits coastal habitats provide to New Jersey. Yet, these ecosystems

ACTIONS

6.3.1 Improve coordination within the DEP to coordinate efforts to protect and enhance tidal marshes

6.3.2 Support an expanded tidal wetland monitoring program and assessment program, enlisting partners, to inform adaptation decisions

6.3.3 Conserve and acquire land as necessary to allow for landward marsh migration

6.3.4 Develop regional sediment management plans for back bay dredging to support beneficial use of dredged material for habitat restoration

Clam Island, Barnegat Bay, NJ

are not being protected in a manner equal to the value they provide. Between 2007 and 2012, Barnegat Bay lost 22,795 acres (11.9 percent) of its marshes.[27]

Climate change effects, especially sea-level rise, pose an existential threat to all coastal habitats and will accelerate the rate of habitat loss. This strategy focuses specifically on actions needed to promote tidal wetland and marsh habitats. The *2020 New Jersey Scientific Report on Climate Change* summarizes just how vulnerable tidal wetlands are to the effects of climate change and how the functions and ecosystem services they provide will be impacted in various ways. The majority of tidal wetlands monitored in the state are not gaining elevation[28] at a rate that keeps pace with sea-level rise.[29] Based on analysis done by the Rutgers University Center for Remote Sensing and Spatial Analysis, if sea-levels rise one to two feet by 2050, approximately 28 percent of existing tidal marshes in New Jersey could be replaced by mud or sand flats, and eventually open water. Just one foot of sea-level rise may cause more than 19,200 acres of tidal marsh to convert to mudflats or open water with an additional 24,800 acres of tidal wetland expected to be lost to erosion.[30] Loss of this protective barrier will increase the flood risk to upland areas that will no longer be protected by marshes and forests, making restoration and conservation of New Jersey's coastal habitats one of the most important resilience strategies.

The continued health of New Jersey's tidal wetlands is also a key component to New Jersey's efforts to mitigate climate pollutants, like greenhouse gases, due to their important carbon sequestration capabilities. According to *New Jersey's Global Warming Response Act 80x50 Report*, "New Jersey must also protect its existing carbon pools by taking action to avoid the loss of natural lands, preserve marsh migration pathways, and defending existing carbon sinks from the dangers of wildlife, disease, pests, and inundation."

Before action can be taken to address the serious threat facing tidal marshes, their current health and capacity to adapt needs to be assessed. There has been extensive work done to assess the condition of various coastal habitats and standardize monitoring protocols, although there has not been a comprehensive study conducted to assess the health and vulnerability of all types of tidal wetlands (salt marsh, brackish marsh, freshwater tidal marsh, and swamp). The DEP, in collaboration with other state agencies and other organizations, should pursue a single statewide monitoring protocol and consistent statewide tidal wetland condition and function assessments to understand the current status of, and project future trends on, the health of coastal habitats.

There are many approaches that can support coastal habitat adaptation to sea-level rise, including the beneficial use of dredged materials for tidal marsh restoration. Several

projects utilizing beneficial use of dredged materials have been deployed since 2013 and are providing the data and lessons needed to lay the foundation for future beneficial use projects. Through these projects, the DEP has identified the need for regional sediment management plans to allow coordination of dredging activity across agencies like the DEP, Department of Transportation (DOT), and USACE, and identification of clean material, and appropriate enhancement sites that will benefit the coastal system through marsh elevation and even the creation and restoration of near shore islands. A regional sediment management plan is also identified as a need in Strategy 6.4.

New Jersey should also undertake efforts that allow tidal wetlands to migrate landward as a means to adapt to sea-level rise. It will be critical to keep coastal upland areas adjacent to tidal marshes free from impediments, such as bulkheads, roads, and other hard structures, to allow marsh migration. A 2014 Rutgers University study showed that nearly 2,000 acres of New Jersey's tidal marshes could be impeded from migrating at one foot of sea-level rise. This estimate is likely to increase by 2050 if coastal development and shoreline hardening continue at the current pace.[31] While marsh migration is influenced by many factors, immediate focus should be on development of an inventory to identify coastal upland ecosystems with the potential as future marsh migration corridors, leveraging programs like the Blue Acres Program to remove development from flood prone areas and develop and adopt best management practices to successfully facilitate marsh migration. For example, the DEP and the DOT should partner to determine where undersized bridges and culverts need to be replaced, and where bridges and culverts could be installed, to allow tidal flow to support areas where roads block marsh migration. Conservation of coastal uplands as marsh migration corridors will be addressed in New Jersey's Coastal Management Program's *2021-2025 Section 309 Assessment and Strategy* for wetlands which will map potential marsh migration areas, investigate acquisition mechanisms for mapped areas, and identify regulatory changes that would help to facilitate acquisition of coastal uplands adjacent to marshes.

To combat the risk that tidal marshes and all coastal habitats face from sea-level rise, a coordinated and united front is needed for coastal marsh management and restoration. The DEP is working to increase its internal coordination through the New Jersey U.S. Department of Environmental Protection (EPA)-approved Wetlands Program Plan, a Living Shorelines Permit Work Group, and the Coastal Management Program to provide consistent and collaborative protocols to research, monitor, manage, and regulate marshes. The DEP should also promote the tools and guidance documents that have been developed by outside organizations in recent years to improve tidal wetlands restoration, and provide trainings for the public on a routine basis to share new information that has been gained from monitoring and experience. The DEP will continue to coordinate with other state and federal agencies and external organizations to supplement and expand the research, projects, and opportunities to protect New Jersey's marshes.

"Climate change effects, especially sea-level rise, pose an existential threat to all coastal habitats and will accelerate the rate of habitat loss. This strategy focuses specifically on actions needed to promote tidal wetland and marsh habitats."

New Jersey's Coastal Habitat

90% *of New Jersey's coastline is protected from exposure to coastal hazards by coastal habitats*

$625M *was saved during Hurricane Sandy due to coastal marshes.*

28% *of existing tidal marshes in New Jersey could be replaced by mud or sand flats by 2050*

Seven Mile Island Innovation Laboratory

In 2019, in partnership with the DEP and the Wetlands Institute, the U.S. Army Corps of Engineers (USACE) launched the Seven Mile Island Innovation Laboratory. The initiative aims to advance techniques for the beneficial use of dredged material through research, collaboration, and practical application. The Seven Mile Island Innovation Laboratory builds upon several successful marsh and avian habitat enhancement projects in past years. Building on a rich historic dataset from these previous projects, new demonstration projects will help develop a more systematic, science-based approach to dredging and habitat restoration. This concept is based on a Dutch "Living Lab for Mud" initiative to test and demonstrate environmental benefits.

Seven Mile Island, located in Cape May County, is a barrier island backed by approximately 24 square miles of tidal marsh, coastal lagoons, tidal channels, and bay that is vulnerable to sea-level rise and is showing signs of degradation. The area was chosen for the Innovation Lab because of its diversity – including existing and historic dredged material placement sites, confined disposal facilities, federal and state channels including the New Jersey Intracoastal Waterway, extensive tidal marshes, and a mixture of sandy and muddy sediments. The marsh provides critical habitat for birds, fish, shellfish, and other wildlife and provides protection from sea-level rise and storm surge for the barrier island communities of Avalon and Stone Harbor.

The Seven Mile Island Innovation Laboratory Working Group was established representing natural resource managers, scientists, engineers, practitioners, communication specialists, and regulators from government, academia, and non-profit organizations to collaborate on an effective restoration design. USACE is collecting sediment and hydrodynamic data and The Wetlands Institute is collecting avian site usage and vegetation. The data is being used to develop initial project designs and placement strategies, with a goal of completing a project by 2021. So far, two habitat projects were implemented in 2020.

STRATEGY 6.4:
Manage Shoreline Stabilization with Nature-based Features

Oyster Shell Bags, Photo Courtesy of Rutgers University

The densely developed nature of New Jersey's coastal zone has created the impression of a static shoreline, when in reality, it is part of a natural coastal system that is highly dynamic and impacted by erosive conditions like tides, waves, and wind. Development patterns and erosion control structures such as groins and bulkheads have resulted in barriers that prevent natural processes from occurring, like accretion of sediment, and prevents the balancing of erosive forces. Sea-level rise and human development will accelerate natural erosion rates, ultimately increasing the hazard to both human development and coastal habitats. As the threat of erosion grows, there will be a greater drive to stabilize coastal shorelines to keep development in place.

Historically, the most common response to erosion was shoreline stabilization through construction of bulkheads to hold the line along beaches and back bay shorelines. While these structures were installed to protect development from erosion, there are significant long-term impacts, to surrounding ecosystems, including a reduction in the services they provide and natural erosion prevention. Additionally, research has found that hard stabilization features do not offer as much protection from high storm surges as once thought. For example, after Hurricane Irene made landfall in 2011 in North Carolina, three quarters of bulkheads were damaged while none of the natural marsh shorelines were impaired.[32] While the natural marshes saw an immediate impact to vegetation, these areas did not sustain a loss of sediment or elevation, and the vegetation recovered within the year.

ACTIONS

6.4.1 Support increased construction of living shorelines through trainings, pilot projects, removal of regulatory barriers, and monitoring to develop performance data

6.4.2 Establish a Restore the Shore program to convert hardened shorelines back to natural shorelines where feasible and effective to stabilize the shoreline

6.4.3 Minimize permitting of new hard shoreline stabilization features in areas not supported by a state-led assessment and mapping effort

6.4.4 Prioritize state investment for new hard stabilization features to projects needed to protect critical infrastructure in major population and economic centers

Recognizing the adverse impacts of hard structures, in recent years New Jersey has promoted natural and nature-based solutions for shoreline stabilization that both protect upland structures and provide ecological benefits. In 2013, the Coastal Zone Management Rules (N.J.A.C. 7:7) were revised to address and facilitate the construction of living shorelines. The definition of a living shoreline allowed by those rules is broad and permits the use of a natural and nature-based features that address the loss of vegetated shorelines, beaches, and habitat through the protection, restoration, or enhancement of these habitats. This definition includes entirely vegetation-based living shorelines, hybrid approaches with a mix of vegetation and structural features, as well as sea grass, oyster reefs, and marshes. As a result, natural and nature-based features are increasingly being used in low-energy environments like back bays. However, use of natural features should be promoted and incentivized across broader types of coastal shorelines.

There is a common misperception that natural features, specifically living shoreline projects, are only appropriate for undeveloped or rural areas, and only applicable along low wave energy environments such as back bays. More effort should be made to increase understanding of the continuum of living shoreline stabilization techniques, and other natural and nature-based features, that are appropriate along a variety of shorelines, including non-tidal riverine and lake areas (which are discussed in Priority 2). The DEP can do more to increase knowledge and understanding around the best use of these measures. By funding and monitoring pilot projects in diverse community types, the effectiveness and adaptability of nature-based features can be demonstrated in a variety of flood conditions, including nuisance flooding and pre- and post-storm conditions.

Living shorelines and all natural and nature-based features should be further incentivized making it easier

"Recognizing the adverse impacts of hard structures, in recent years New Jersey has promoted natural and nature-based solutions for shoreline stabilization that both protect upland structures and provide ecological benefits"

Living Shoreline, Brigantine, NJ

Mordecai Island Living Shoreline

From 2017 to 2019, the DEP issued several General Permits No. 24 under the Coastal Zone Management Rules for stabilization of the shorelines along Moredcai Island, located in the Borough of Beach Haven, Ocean County. The goal of the project was to improve the resilience of the southwestern shoreline and curb erosion resulting from recreational boating wakes. The project included the construction of an oyster castle breakwater consisting of four oyster castles, including oyster spat and ribbed muscles, along the southwestern shoreline of the island, the placement of five Wave Attenuation Devices (WADs), and 14 small-scale oyster castle marsh sills. The purpose of the smaller marsh sills was to absorb residual wave energy, accrete material, and provide substrate for plants, oysters, and ribbed mussels.

and less costly for property owners to install over a hard stabilization feature. During preparation of this strategy, stakeholders communicated the desire to see more living shoreline projects and less bulkheads in the coastal zone and acknowledged the significant strides the DEP has made in addressing permitting barriers for applicants seeking to advance restoration and enhancement projects. However, they also noted that it is still easier to replace bulkheads in-kind due to permitting requirements and the experience and knowledge of contractors. State and federal agencies should continue to work together to further streamline application and review procedures to promote natural and nature-based features.

The DEP could also provide guidance for property owners and contractors to determine the type of natural or nature-based feature that would be most appropriate for their shoreline by linking permit decisions to a statewide assessment and mapping effort that identifies appropriate stabilization measures based on specific shoreline conditions, the criticality of upland development, and other consideration. This effort should be coordinated with the DEP's Coastal Ecological Restoration and Adaptation Plan discussed in more detail in Strategy 6.7, which includes a mapping assessment to prioritize and identify appropriate ecological enhancement projects.

New Jersey should also consider opportunities to reduce, and when possible and appropriate, remove existing hard stabilization features. A Restore the Shore Program could be established that provides information and demonstrates the actions needed to remove hard stabilization structures or re-engineer them with nature-based features. The program could also incorporate opportunities to identify barriers and disincentives that are limiting the use of restoration and enhancement projects, establish a commitment to expand state funding for ecological projects, and increase incentives for homeowners to replace bulkheads with living shorelines. Such incentive programs are further discussed in Strategy 6.8.

The Interagency Council recognizes the need to stabilize shorelines along New Jersey's diverse shorelines to protect upland development, but that it is not always necessary to do so at the peril of natural shorelines. The state will continue to invest in all types of coastal resilience strategies to protect and enhance state and community assets but will prioritize non-structural and natural and nature-based features, except where technically infeasible. New Jersey will prioritize state investment for new hard stabilization features to projects needed to protect critical infrastructure in major population and economic centers

STRATEGY 6.5: Manage Coastal Beaches and Dunes to Reduce Erosion and Storm Damage

ACTIONS

6.5.1 Adapt beach and dune designs to changing conditions

6.5.2 Evaluate oceanfront shoreline erosion and deposition rates for future beach nourishment projects

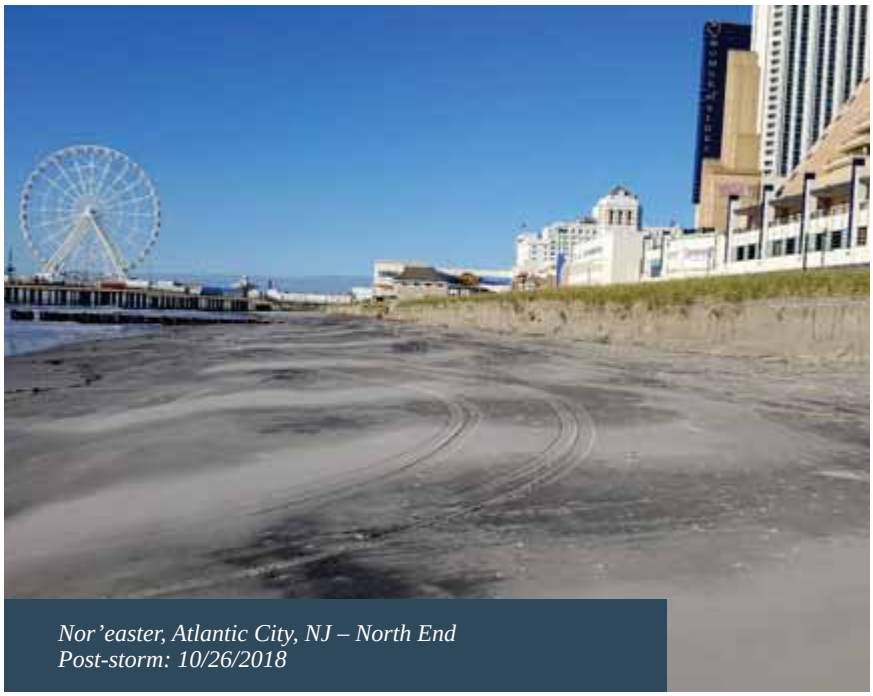
6.5.3 Improve coordination between state and federal agencies to approve new sand borrow sources for beach and dune nourishment

Dune Revegetation, Surf City, NJ

New Jersey's barrier island beach and dune ecosystems, including the beach, dune, and integral back bay wetlands and marsh islands are critical to the social, ecological, and economic fabric of the state. The beach and dune systems are the first line of defense against ocean waves and storm surge for vulnerable homes, businesses, infrastructure, and habitats not only located on the barrier island but on the mainland as well. New Jersey's beach and dune systems protect billions of dollars of coastal development and the multi-billion-dollar tourism and coastal recreational industries that rely on beaches and back bays for recreation and intact ecosystems. Beaches and dunes are some of New Jersey's most valuable natural resources, yet most of them sustain repetitive erosion from coastal storms and often do not receive sand replenishment for years at a time. These impacts are only expected to increase due to sea-level rise and the increased intensity of coastal storms,[33] putting the communities, economy, and ecosystems at greater risk to flooding.

After Hurricane Sandy, the United States Army Corp of Engineers (USACE) estimated that beach and dune restoration projects in New York and New Jersey saved $1.3 billion in avoided damages.[34] In New Jersey, the restoration and maintenance of beaches is a shared effort between the state, federal, and local governments, and to a lesser extent non-governmental organizations, but is administered by the DEP with monies from the Shore Protection Fund. Since Hurricane Sandy, New Jersey has

Nor'easter, Atlantic City, NJ – North End
Pre-storm: 9/7/2018



Nor'easter, Atlantic City, NJ – North End
Post-storm: 10/26/2018

These pictures are an example of the severe erosion that can occur from winter storms.

spent over $1.2[iii] billion rebuilding the barrier island beach and dune system along the Atlantic Ocean coastline using funding from federal aid programs and the Shore Protection Fund's $25 million annual state appropriation. That amount is insufficient to fund ongoing beach nourishment and maintenance costs, let alone support additional project requests from local jurisdictions. Since 2018, almost the entire annual appropriation from the Shore Protection Fund has been allocated to the DEP's cost-share for USACE projects. As climate change will only increase the need and frequency to renourish beach and dune systems, the cost to maintain and keep these valuable systems in place will increase. Additional resources should be considered to allow maintenance of this valuable resource for as long as possible.

The DEP will continue the work closely with the USACE to improve the efficacy and adaptability of engineered beach and dune designs, accounting for erosion and deposition rates, identification of new sand sources to supply nourishment projects, and increase the ability of engineered beach and dune designs to adapt to changing conditions. The DEP and USACE are developing a Regional Sediment Management Plan for projects within the Philadelphia District of the USACE to reduce costs, sand resource requirements, and environmental impacts of beach and dune nourishment projects by proposing alternate sediment sources and harvesting methods. Regional Sediment Management Plans are also identified as a need in Strategy 6.2. The

"Beaches and dunes are one of New Jersey's most valuable natural resources, yet most of them sustain repetitive erosion from coastal storms and often do not receive sand replenishment for years at a time."

[iii] $1.2 Billion – USACE beachfills ($1.07 billion federal, $164 million state/local); $18.4 million – New Jersey administered beachfill (Holgate/Beach Haven). For a comprehensive list of current, on-going, and planned shore protection projects undertaken by the state and a list of requested projects, see Appendix.

DEP should also work in partnership with USACE and academic institutions to develop more accurate models of future erosion rates that account for New Jersey's sea-level rise projections to determine areas that would benefit from cost-effective project modifications, such as increased berm elevation and the addition of dunes where not already present. These models should also be used to identify areas where maintenance of beaches and dunes may become unsustainable in the future and develop an alternative resilience strategy for these areas in partnership with local governments.

The USACE should assess adaptable beach designs to account for the changing conditions that occur after an engineered beach and dune are completed. For example, most oceanfront dunes are planted with beach grasses that thrive in windy, salt-sprayed environments. Over time, as the grasses expand onto the beach, they create a new dune that blocks wind and ocean spray from the engineered dune, causing grasses to die-off. However, the changing ecological conditions are not accounted for prior to renourishment and replanting occurs with the same deficient dune ecosystem. A recommendation could be made to assess the beach and dune prior to renourishment and adapt designs to changing conditions. This will allow for structural integrity and the creation of a diversely vegetated dune habitat that will protect the ecosystem services provided by barrier islands.

The Interagency Council recognizes the importance of the barrier island beach and dune systems in New Jersey for the benefits they provide, but also recognizes the increasing cost to maintain this system. New Jersey will continue to invest in beach and dune projects that protect coastal ecosystems, tourism and recreational industries, and existing coastal development, but the state must continue to evaluate the risks, benefits, and cost-effectiveness of these investments.

Island Beach State Park, NJ

STRATEGY 6.6:
Reduce Flood Risk to Existing Buildings and Infrastructure

Jersey City, NJ

New Jersey is the most densely populated state in the United States, with 80 percent of the population residing in the coastal zone. Development patterns have resulted in a high density of buildings and infrastructure in vulnerable coastal areas which are subject to routine flooding from high tides, tropical storms and hurricanes, and winter storms like nor'easters. Approximately 73 percent of all of New Jersey's National Flood Insurance Policy (NFIP) claims come from, and approximately 81 percent of dollars paid by the Federal Emergency Management Agency (FEMA) go to, the coastal zone.

As sea-level rise continues, the buildings and infrastructure along New Jersey's coast will be exposed to more frequent and intense flooding events. Plans to address current and future climate change conditions must not only address the need to manage beach and dune systems, stabilize shorelines, and protect tidal wetlands and communities, but must also address the existing critical buildings and infrastructure that are at risk now and in the future. If existing buildings and infrastructure are not adapted for future climate change conditions, every day functions will increasingly be interrupted leading to impacts on every aspect of life.

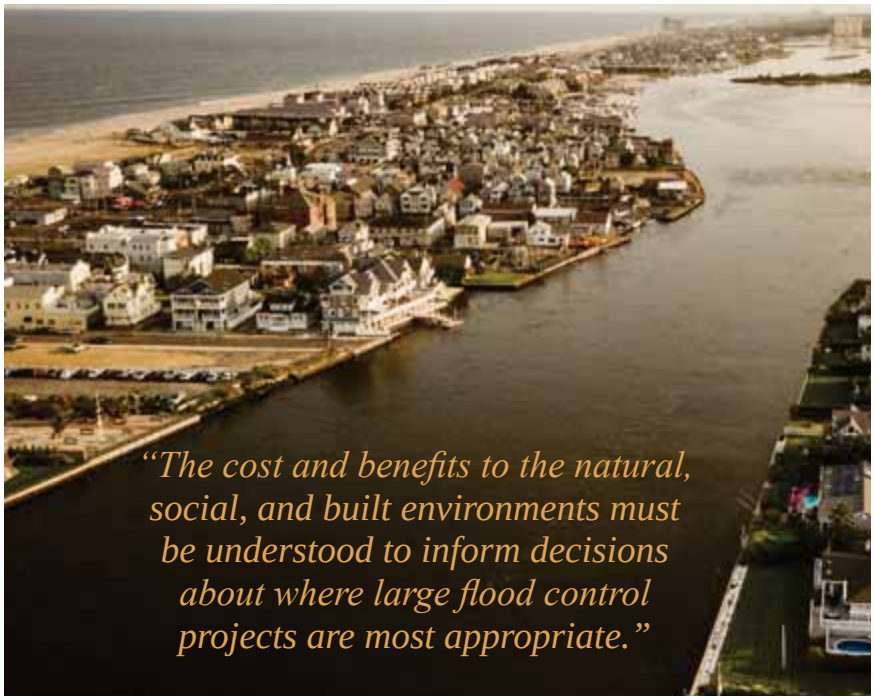
The elevation, protection, and floodproofing of any critical infrastructure must also be done in coordination and consideration of the elevation, protection, and floodproofing of surrounding structures and utility systems (gas, electric, water, and sewer) to ensure negative conditions

ACTIONS

6.6.1 Coordinate elevation, protection, and floodproofing of homes, businesses, and critical infrastructure as part of comprehensive risk reduction planning

6.6.2 Prioritize large coastal flood control projects that protect large population and economic centers, areas with concentrations of critical infrastructure, or in areas with socially vulnerable populations

6.6.3 Consider long-term operation and maintenance cost and responsibilities in evaluating project costs



Shrewsbury River, NJ

are not exacerbated. For example, efforts to raise evacuation routes and other roads may result in flooding of adjacent properties that remain at lower elevations. Utility systems must also be included in plans to ensure service to communities can be maintained through changing conditions. As climate change poses new challenges, the Board of Public Utilities (BPU), the Department of Community Affairs (DCA), and DEP should continue to collaborate to ensure reliability and resilience of the system.

The cost and benefits to the natural, social, and built environments must be understood to inform decisions about where large flood control projects are most appropriate. State agencies will prioritize major flood protection investments to major population and

Rebuild By Design (RBD): Meadowlands Project

The RBD Meadowlands project focuses on a 5,000-acre area on the Hackensack River consisting of Carlstadt, Little Ferry, Moonachie, South Hackensack and Teterboro. The project aims to protect critical infrastructure, businesses, residences, and ecological resources, and increase awareness of resilience and water management in the region.

In the East Riser Watershed portion of the project area, channel improvements create more capacity for rainwater to drain during storms and a new pump station will move more water out of the channel. Habitat is enhanced by planting native plants along the banks where feasible. In the Losen Slote Watershed, an existing bottleneck is alleviated with a new pump station that will pull water out of the existing pipe and through a force main that discharges downstream.

Along the Hackensack River, if funding allows, a new public park would provide public access on the river, improve biodiversity, restore the shoreline with tidal marsh and provide an accessible kayak launch. To improve ponding after rain events near public buildings, infiltration of rainwater would be enhanced by implementing green infrastructure improvements.

East Riser Ditch Pumping Station & Channel Improvements (AECOM)

The project is just one piece of a larger network needed to address the complex environmental challenges ahead. The designed project is a scalable, regional approach, with replicable strategies for other watersheds in New Jersey.

economic centers, concentrations of critical infrastructure systems, or in areas with socially vulnerable populations. To assist the DEP in administering Shore Protection Funds, development of a data-driven and transparent Geographic Information System-based Decision Support System is underway to inform its decision-making. The DEP also acknowledges the need to understand the long-term cost of operating and maintaining large flood control projects when factoring the cost and benefit to the natural, social, and build environments. These costs are often fall to the DEP because they are prohibitive for local jurisdictions. As the need for large flood control projects increases the DEP will consider how public funds are used efficiently spent in protection of the coastal zone.

Newark, NJ

Rebuild by Design (RBD): Hudson River Project

The RBD Hudson River project, also known as the "Resist, Delay, Store, Discharge" project, is a comprehensive urban flood risk reduction strategy that will deploy various techniques to overcome flooding challenges in Hoboken, the southern portion of Weehawken, and the northern portion of Jersey City. Each component of the project will use different methods, such as programmed hard infrastructure and soft landscape for coastal defense (Resist); policy recommendations, guidelines, and urban infrastructure to slow rainwater runoff (Delay); develop interconnected green and gray infrastructure to store and direct excess rainwater (Store); and water pumps and alternative routes to support drainage (Discharge).

Northwest Resiliency Park located in Hoboken, NJ will integrate green infrastructure and innovative stormwater management measures to mitigate flooding from rainfall events. (OLIN)

The Resist component of the project includes a variety of flood risk reduction infrastructure, such as walls and gates, that will be integrated into the fabric of the city. As a part of this integrated approach, a 3-acre public park will include ample space for a waterfront lawn, recreational activities, and a playground, while incorporating elevated flood protection features, including the Resist structure.

The Delay, Store, Discharge, components are being constructed by the City of Hoboken. Northwest Resiliency Park, which converts a paved and impermeable surface into open green space with an underground stormwater storage tank, is nearing completion. Other elements consist of additional stormwater detention facilities that include new and improved stormwater management techniques and other smaller rainwater storage tanks throughout the city.

STRATEGY 6.7: Make Smarter and More Coordinated Investments in Coastal Resilience

ACTIONS

6.7.1 All state-funded projects must align with the *Coastal Resilience Plan* and be presented to the Interagency Council for informational and coordination purposes

6.7.2 Enhance coordination across agencies to leverage funding sources and maximize co-benefits to address multiple project needs

6.7.3 Prioritize state agency funding for resilience infrastructure to protect large population and economic centers, areas with concentrations of critical infrastructure, and socially vulnerable populations

6.7.4 Evaluate future Shore Protection Fund projects by using the Decision Support System

Camden, NJ Waterfront

State and local governments, individuals, businesses, and non-profit organizations have invested almost $9 billion[35] in coastal flood mitigation projects since Hurricane Sandy. This largely occurred through stand-alone projects completed with agency-specific funding and directives. As flooding and the scope of areas at risk increase, so will the strain on state agency resources. These factors will make a project-by-project approach to flood risk response less effective. State agencies will need to coordinate actions, projects, and decision-making around long-term resilience major planning, not just post-disaster. Climate change will necessitate taking advantage of synergies within all state agencies and projects to effectively protect the coastal zone.

Given the increasing vulnerability of New Jersey's coast, state and local government finances will not be sufficient to fund resilience projects that protect every vulnerable area, and governments will need to prioritize and coordinate limited fiscal resources for resilience. All coastal flood protection actions across state agencies must be founded in resilience principles and developed with long-term sea-level rise adaptation in mind. For example, the Board of Public Utilities, as stated in the *Energy Master Plan*, will steer investments for solar energy away from flood zones and other areas deemed especially vulnerable to climate change, adding resilience from sea-level rise and storm events to the energy sector. While each state agency has its own processes, mandates, authorities, and funding requirements, the Interagency Council recognizes the need to better coordinate funding and decision-making and will establish a coordinated approach to ensure all participating agencies are aware of major projects in other agencies. To be clear, this action is not another level of review, but is intended to ensure that each agency is making decisions fully informed by current data, consistent with the investments of other agencies, and addressing conflicts that may exist. All projects should align with the greatest need,

and must consider natural features, underserved populations, and equity. This strategy does not mean projects that do not meet these criteria will not be funded, but that state agencies should consider the most effective way to utilize public dollars.

Collaboration of the Interagency Council in this manner will provide state agencies the ability to leverage funds available through federal grants from agencies like USACE, National Oceanic and Atmospheric Administration (NOAA), FEMA, the U.S. Department of Housing and Urban Development (HUD), United State Environmental Protection Agency (EPA), and the National Fish and Wildlife Foundation (NFWF). Most of New Jersey's coastal resilience actions are subsidized by these federal funding sources, which may be competitive, and in some cases, available only after disasters. Collaboration will increase New Jersey's ability to acquire funding and maximize co-benefits to address multiple project needs.

In addition to increased coordination, state agencies can begin to meet the growing need for coastal resilience by evaluating project prioritization. Funding will be prioritized for resilience infrastructure to protect population and economic centers, areas with concentrations of critical infrastructure, or in areas with socially vulnerable populations. As noted in Strategy 6.6, the DEP will utilize its Decision Support System when evaluating how to use future Shore Protection Funds. The DEP will also prioritize ecological projects, and restoration and preservation funds, through a Coastal Ecological Restoration and Adaptation Plan that is currently under development with funding from EPA. This effort builds on work funded by NOAA through the Coastal Management Program to create a methodology to prioritize opportunities for preservation, restoration, and enhancement of natural resources within the coastal zone. A stable funding source would be beneficial for DEP to implement ecologically based projects prioritized through this process. Currently, Shore Protection Funds are utilized largely for implementation of USACE coastal storm damage reduction projects. The authority to use and implement these funds should be updated to allow DEP the ability to implement non-structural and nature-based resilience strategies in efforts to protect shorelines.

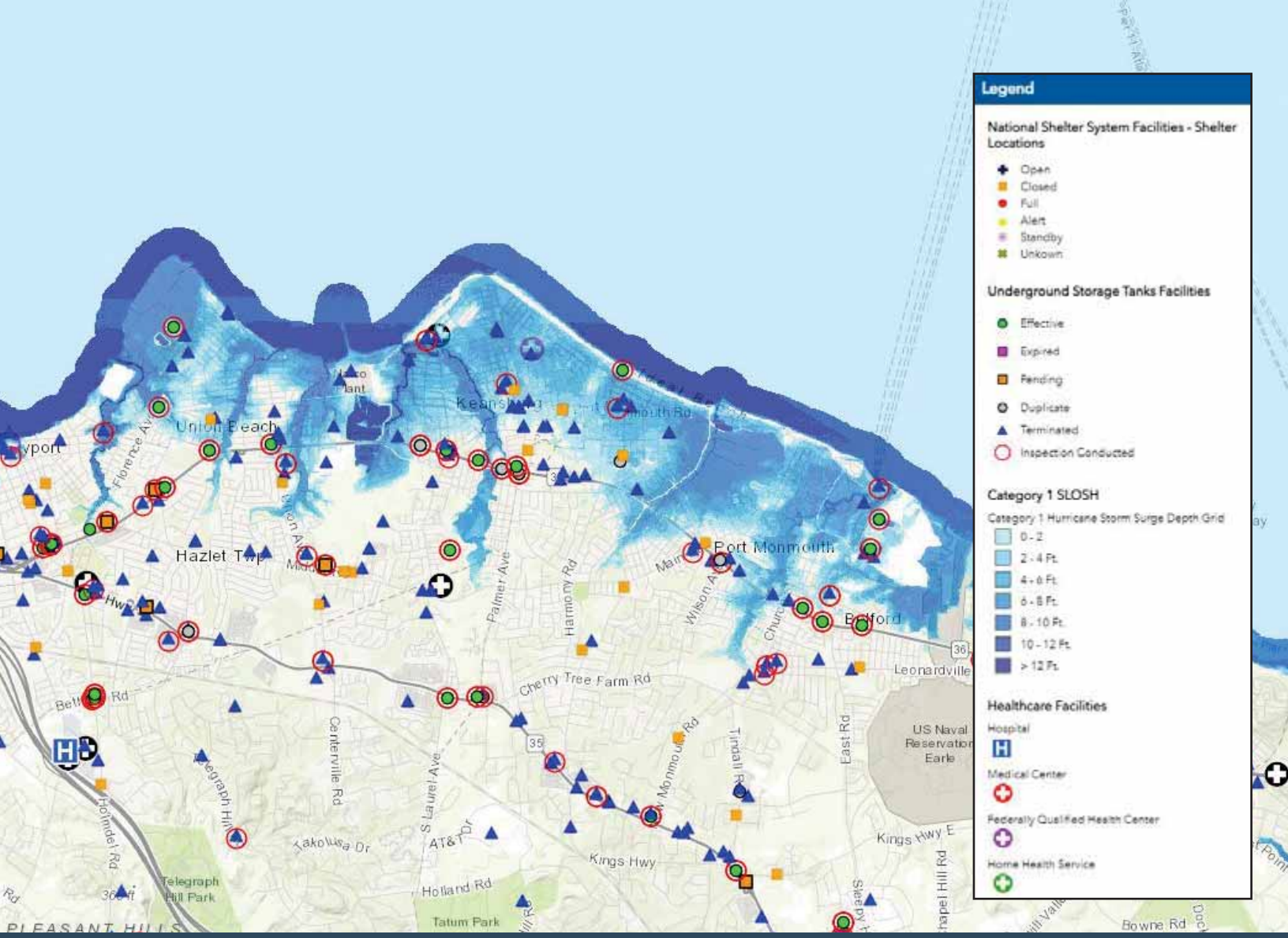
This plan will not recommend any specific funding methods, but there must be recognition that the cost of climate change impacts, especially sea-level rise and more intense storms, will continue to increase into the future. The average annual hurricane-related loss from wind and flooding in New Jersey today is anticipated to be between $670 million to $1.3 billion higher than it was in 1980 due to sea-level rise.[1] This increase in cost is only expected to continue as sea-level rise worsens and hurricane and other storm impacts expand farther inland. For New Jersey to equitably increase coastal resilience, additional funding streams and mechanisms are needed. Potential options include bonding, taxes, fees, or innovative alternatives such as resilience and environmental impact bonds, property assessment resilience funding, tax sharing, special improvement districts, or a regional resilience trust fund, some of which are addressed in more detail in Priority 5.

ACTIONS

6.7.5 Prioritize ecological projects through a Coastal Ecological Restoration and Adaptation Plan

6.7.6 Update the Shore Protection Fund authority to include non-structural and nature-based resilience strategies

6.7.7 Fund future coastal resilience projects through new bonds, taxes, fees, and/or innovative funding mechanisms



New Jersey Department of Environmental Protection's Decision Support System

Within the context of, and informed by, the *Coastal Resilience Plan*, the DEP has produced a Decision Support System that will help guide DEP in the development and funding of coastal storm damage reduction and flood risk reduction strategies and projects. The DEP, Climate and Flood Resilience Program, makes decisions and recommendations regarding the allocation of funds for projects along the New Jersey coast. To improve that process, the Decision Support System presents environmental, economic, and social data that must be considered for efficient and effective risk management with limited resources in a changing coastal environment. The data will provide DEP with the rationale for funding allocations.

The Decision Support System utilizes existing internal and external data from various state and federal resources within a geographic information system platform to facilitate the comprehensive assessment of the costs and benefits of proposed projects. Through the lens of risk assessment, mitigation costs and full societal project benefits, the Decision Support System includes a geoprocessing tool to provide environmental, economic, and social values relevant to address near-future risks and highlight challenges that threaten the vitality and productivity of the state. The Decision Support System is designed to provide information to facilitate evaluation of existing and anticipated DEP coastal storm flood strategies and projects, which include, but are not limited to, bulkhead replacement, jetty repair, beach replenishment, dune hardening, and ecosystem restoration. As part of this effort, a database of past and current shore protection projects is being created to better identify how each project can integrate into a regional and statewide coastal resilience approach.

STRATEGY 6.8: Share Financial Responsibility for Resilience

Meadowlands, NJ

As climate change increases flooding and erosion in coastal areas, New Jersey increasingly faces the need for new coastal resilience plans and projects, including upgrades to existing flood risk reduction infrastructure. Current funding sources are not able to keep pace with the demands of climate change. This strategy recognizes that for New Jersey to decrease coastal flood risk, all levels of government, and private and nonprofit organizations should share resilience costs. As climate change will require an "all hands on deck" approach, so too must the financial burden be shared beyond state government.

As previously noted, the $25 million annual budget of the Shore Protection Fund is the only guaranteed funding for shore protection projects and is largely allocated for the state to cover the non-federal cost-share responsibility for USACE coastal storm damage reduction projects, limiting the DEP's ability to support additional projects. Local governments can actively participate in reducing flood risk through implementation of local projects and participation in federally funded projects. The Interagency Council should encourage local and county governments to pursue local flood risk reduction projects through partnerships with the USACE or other funding sources. Policies should also be updated to make it easier for local participation in federal projects. Federal projects require a non-federal cost-share which is often a combination of state and local funds. The percentage of funding local governments contribute can vary and is

ACTIONS

6.8.1 Require local commitment to long-term operation and maintenance of resilience projects

6.8.2 Update state-local cost shares requirements to be more equitable

6.8.3 Encourage private property owners to adapt to sea-level rise

6.8.4 Encourage local and county commitment to finance local resilience projects

6.8.5 Assess insurance and finance trends related to the impacts of sea-level rise for coastal properties

determined by the state government. Given the ability of municipalities to pay for coastal resilience projects varies significantly, a process should be developed to determine equitable cost-share ratios for future projects.

Commitment from local governments to participate in reducing flood risk around the coastal zone will be necessary. One opportunity is to share in the cost of long-term operations and maintenance of resilience projects that have been built in collaboration with state and/or federal governments. Costs associated with operations and maintenance of constructed projects currently requires substantial state funding. However, for beach nourishment projects, responsibilities for routine maintenance and operations have been mostly delegated to local governments. Given local jurisdictions are the primary beneficiaries of projects and the need to maximize the use of limited state funds, local jurisdictions could retain primary responsibility for operations and maintenance of completed federally-funded flood control projects that fall within municipal borders. Local operations should be supported through guidance, technical assistance, training, and continued coordination with the federal government. This would reduce state costs allowing funds to be directed to new project construction.

Private property comprises the majority of New Jersey's coastline; incentives for private property owners to reduce flood risk through implementation of flood adaptation measures should be considered. For example, tax rebates or credits could be provided to incentivize property owners to install a living shoreline or other green infrastructure or replaces a bulkhead with a living shoreline. Other incentives could include grants for project design or reduced or waived permit fees. Private property owner implementation such flood adaptation measures will have the secondary effect of reducing the financial burden on local and state governments.

The insurance, banking, and real estate markets have already begun to see shifts as conditions along the coast change and flood more often. Some municipalities have seen bond ratings lower in the wake of Hurricane Sandy or increased in response to resilience initiatives. More research is still needed to understand the implications of sea-level rise on New Jersey's housing market,[36] but there is a concern that lenders may suffer large losses if homeowners stop making mortgage payments on properties suffering from chronic flooding.[37] Recent reporting indicates lenders are starting to mitigate this risk by selling flood prone properties to large public institutions like Freddie Mac and Fannie Mae passing individual risk further onto governments.[38] There must be a more proactive effort to anticipate and prepare for the shifts in markets. This action would initiate that effort to improve modeling and research to inform future actions.

"The Interagency Council should encourage local and county governments to pursue local flood risk reduction projects through partnerships with the USACE or other funding sources."

Keansburg, NJ

STRATEGY 6.9: Support and Incentivize Movement to Safer Areas

Donald Goodkind Bridge, NJ

Flooding has always affected New Jersey's coastal communities, but sea-level rise will exacerbate the intensity and extent of storm surge flooding and increase the frequency and severity of recurring tidal nuisance flooding that will eventually result in the permanent inundation of some low-lying areas. Action must be taken now to prepare communities for the inevitable shift that will occur as people, businesses, and coastal functions move to safer areas.

Alternately referred to as managed retreat, managed realignment, resilient relocation, or transformational adaptation, whatever the term, the result is the same; whether through individual or market decisions, people, businesses, and coastal functions will eventually move to safer areas. While large-scale managed retreat from New Jersey's coast is unlikely to be necessary or mandated in the immediate future, planning, policy, and regulatory actions must be taken now to alleviate the potential economic and societal losses that will be caused by significant unplanned migration away from vulnerable areas. Coastal stakeholders may disagree about the implementation of managed retreat as a resilience strategy, but sea-level rise will ultimately make it a necessary consideration.

Many of the actions included throughout the *Coastal Resilience Plan* are interim actions to ensure that later decisions are less costly and disruptive. State agencies should take additional steps to identify the regulatory and policy reforms needed to prepare for and facilitate the evolution of the coastal zone. This may include support for populations when moving to

ACTIONS

6.9.1 Expand New Jersey's Blue Acres program, supporting buyouts of repeatedly flooding properties, especially for vulnerable populations

6.9.2 Require and/or incentivize local (county and municipal) plans to evaluate relocation opportunities for populations in areas subject to repetitive flooding or inundation

6.9.3 Expanding relocation programs to encourage relocation to safer areas

6.9.4 Evaluate future State relocation policy opportunities and obstacles through an analysis of planning, economic, and legal factors

ACTIONS

6.9.5 Evaluate policies and funding options to support anticipated future demand for buyouts in flood-prone areas

6.9.6 Limit major state investment in new infrastructure in accordance with projections for sea-level rise and inundation

6.9.7 Identify financial incentives for more resilient building in safer areas

safer areas, exploration of the legal and economic impacts of relocation, and where, when, and in what circumstances it may be necessary to limit major investment for new infrastructure in the most at-risk areas. The state should also consider incentives to build or redevelop in safer areas, such as reduced or waived permitting fees, tax breaks, available funding for development and redevelopment that meets specific requirements, and rebate programs for building and rehabilitation of structures consistent with a set of designated parameters. The Interagency Council will coordinate to limit major investment of new infrastructure in areas that are currently or projected to experience routine flooding.

Local governments must also consider the issue as unplanned movement out of vulnerable areas could impact local plans and budgets. To incentivize this action, the state should require and/or incentivize municipal and county resilience plans to identify potential relocation areas based on existing repetitive loss properties and projected sea-level rise inundation. This will improve property owners' understanding of future risk, while also informing investments at all levels of government.

Structural elevation is a traditional post-storm response to flood risk, but is only a long-term solution if the federal, state, local governments, utilities and others, commit to adapting and maintaining surrounding infrastructure and utilities that service those structures in perpetuity. Sea-level rise projections suggest that such government efforts would be needed in more areas in the future, making them more costly, and eventually unviable in certain areas. As such, it will be increasingly difficult for people to live and work in coastal places as sea-level rise inundation increases in magnitude and extent.

As far back as the *1981 Shore Protection Master Plan* there was a noted need for programs to encourage relocation out of coastal hazard areas after destructive storms and post-storm acquisition of portions of barrier islands. New Jersey created the Blue Acres Program in 1995 to help move people out of harm's way and protect communities from flooding by providing open space as flood buffers. The Blue Acres program is a nationally recognized success story and is on its way to buying out 1,000 flood prone properties since Hurricane Sandy. New Jersey should build on

Cape May, NJ

the success of the Blue Acres Program seeking to expand the program and implement additional homeowner support measures. Even with existing annual appropriations, fiscal limitations prevent the buyout of all homes from interested property owners living within flood-prone areas. This strategy proposes that the Interagency Council work with the legislature and federal partners to find new and larger pots of money to deal with the anticipated influx of buyout demand.

While the Blue Acres Program offers relocation assistance, homeowners are not required to participate, so New Jersey is not able to track where every seller chooses to move. Some sellers have taken a buyout only to relocate to another vulnerable area, putting themselves at risk and perpetuating the need and expectation of a government buyout in the future. If the demand for buyout and relocation assistance programs increase to a point where current acquisition programs are unsustainable, reforms should be explored including adding seller relocation contingencies to future buyout contracts, only allowing one buyout per property owner over a lifetime, and precluding buyout of any newly constructed homes in inundation areas.

Blue Acres Property, Linden, NJ

Blue Acres

As of 2019, the Blue Acres Program has received dedicated annually funding from the Corporate Business Tax Act (C.54:10A-1 et seq.) to acquire property in tidal and non-tidal flood prone areas. The program also leverages federal funding from the HUD and FEMA. Since Hurricane Sandy, Blue Acres has secured funding for 1,185 properties and made offers on 1,114 properties in 20 municipalities across ten counties. As of February 2021, 827 homeowners have accepted buyout offers, with 755 having closed. More than 697 homes have been demolished and removed from these purchased properties, increasing flood mitigation and further protecting inland communities. Much of this interest has occurred in riverine areas. As sea-levels continue to rise, this demand will expand into new areas.

The Blue Acres Program seeks to expand capacity where possible to meet the needs of communities. Early on in the program, it became evident that a number of property owners who were interested in a buyout could not move forward because of being "underwater" on mortgages. To help these owners move to safer ground, the program created a team to negotiate with mortgage lenders. Since Sandy, the program has negotiated $5.7 million in debt forgiveness on behalf of homeowners. Another successful homeowner support activity, the tenant relocation program provides relocation assistance to displaced tenants who reside in properties that will be acquired by the Blue Acres Program to help these tenants make an efficient and smooth transition to replacement housing. Every measure is taken to ensure the replacement housing is decent, quality housing, and is not located in a repetitive flooding area by 1) inspecting the property to make sure it meets HUD's housing quality standard and 2) verifying through FEMA mapping that the property is outside a vulnerable area. Tenants receive a list of decent and safe comparable housing outside the repetitive flooding areas, a relocation benefit, and advisory services, if needed, provided by third party agencies. Since 2016, 45 households have relocated and $1.23 million in relocation benefits have been expended.

The Blue Acres Program is currently exploring the potential for partnerships with housing relocation experts from within buyout communities who could support property owners' efforts to move to higher ground within the existing community. As the program continues to work with communities and address the unique needs and impacts affecting each community, it will continue to expand its capacity to meet the needs of New Jersey's communities.

PRIORITY 6 NOTES:

[1] Hess, H., D. Michael, A. Hamidi, T. Houser, R. Kopp, I. Bollinger, S. Hsiang, M. Greenstone. 2019. New Jersey's Rising Coastal Risk, Rhodium Group. New York, NY.18 pp.

[2] New Jersey Department of Environmental Protection. 2020. New Jersey Scientific Report on Climate Change. Version 1.0. (Eds. R. Hill, M.M. Rutkowski, L.A. Lester, H. Genievich, N.A. Procopio). Trenton, NJ. 184 pp.

[3] Catania, T., and M. Danihel. 2013. New Jersey Endangered and Threatened Species Field Guide. Conserve Wildlife

[4] Schuster, Elizabeth. 2014. Lower Cape May Meadows Ecological Restoration: Analysis of Economic and Social Benefits. The Nature Conservancy, New Jersey Chapter.

[5] New Jersey Department of Transportation. 2019. Overview of the New Jersey Department of Transportation's Office of Maritime Resources. Website. https://www.state.nj.us/transportation/freight/maritime/

[6] State of New Jersey, Office of Emergency Management. 2019. New Jersey State Hazard Mitigation Plan, Section 4 – State Profile.

[7] Hess, H., D. Michael, A. Hamidi, T. Houser, R. Kopp, I. Bollinger, S. Hsiang, M. Greenstone. 2019. New Jersey's Rising Coastal Risk, Rhodium Group. New York, NY.18 pp.

[8] New Jersey Business & Industry Association. 2017. The Economic Impact of Tourism in New Jersey. 5 pp.

[9] State of New Jersey, Office of Emergency Management. 2019. New Jersey State Hazard Mitigation Plan, Executive Summary.

[10] Monmouth County Planning Board. 2018. Monmouth County Summer Coastal Population Study. 43 pp.

[11] New Jersey Department of Environmental Protection. 2020. New Jersey Scientific Report on Climate Change. Version 1.0. (Eds. R. Hill, M.M. Rutkowski, L.A. Lester, H. Genievich, N.A. Procopio). Trenton, NJ. 184 pp.

[12] Kopp, R.E., C. Andrews, A. Broccoli, A. Garner, D. Kreeger, R. Leichenko, N. Lin, C. Little, J.A. Miller, J.K. Miller, K.G. Miller, R. Moss, P. Orton, A. Parris, D. Robinson, W. Sweet, J. Walker, C.P. Weaver, K. White, M. Campo, M. Kaplan, J. Herb, and L. Auermuller. New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel. Rutgers, The State University of New Jersey. Prepared for the New Jersey Department of Environmental Protection. Trenton, New Jersey.

[13] Kopp, R.E., C. Andrews, A. Broccoli, A. Garner, D. Kreeger, R. Leichenko, N. Lin, C. Little, J.A. Miller, J.K. Miller, K.G. Miller, R. Moss, P. Orton, A. Parris, D. Robinson, W. Sweet, J. Walker, C.P. Weaver, K. White, M. Campo, M. Kaplan, J. Herb, and L. Auermuller. New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel. Rutgers, The State University of New Jersey. Prepared for the New Jersey Department of Environmental Protection. Trenton, New Jersey.

[14] Union of Concerned Scientists. 2018. Underwater: Rising Seas, Chronic Floods, and the Implications of US Coastal Real Estate. 28 pp

[15] Union of Concerned Scientists. 2018. Underwater: Rising Seas, Chronic Floods, and the Implications of US Coastal Real Estate. 28 pp

[16] Climate Central. 2019. Ocean at the Door: New Homes and the Rising Sea. 2019 Edition. 9 pp.

[17] Climate Central. 2019. Ocean at the Door: New Homes and the Rising Sea. 2019 Edition. 9 pp.

[18] Climate Central. 2019. Ocean at the Door: New Homes and the Rising Sea. 2019 Edition. 9 pp.

[19] New Jersey Coastal Management Program. 2020. New Jersey Coastal Management Program Section 309 Assessment and Strategy 2021-2025. Trenton, NJ. 195 pp.

[20] http://tworiversonefuture.nj.gov/

[21] Climate Central. 2019. Ocean at the Door: New Homes and the Rising Sea. 2019 Edition. 9 pp.

[22] https://www.nj.gov/dep/njpact/

[23] Liu, S., R. Costanza, A. Troy, J. D'Aagostino, and W. Mates. 2010. Valuing New Jersey's ecosystem services and natural capital: A spatially explicit benefit transfer approach. Environmental Management 45:1271–1285.

[24] Duke University Nicholas Institute and the U.S. Climate Alliance. 2020. Coastal Protection and Blue Carbon: New Jersey. Factsheet. 4 pp.

[25] Narayan, S., Beck, M.W., Wilson, P., Thomas, C., Guerrero, A., Shepard, C., Reguero, B.G., Franco, G., Ingram, C.J., Trespalacios, D. 2016. Coastal Wetlands and Flood Damage Reduction: Using Risk Industry-based Models to Assess Natural Defenses in the Northeastern USA. Lloyd's Tercentenary Research Foundation, London.

[26] Narayan, S., Beck, M.W., Wilson, P., Thomas, C., Guerrero, A., Shepard, C., Reguero, B.G., Franco, G., Ingram, C.J., Trespalacios, D. 2016. Coastal Wetlands and Flood Damage Reduction: Using Risk Industry-based Models to Assess Natural Defenses in the Northeastern USA. Lloyd's Tercentenary Research Foundation, London.

[27] Weis, J.S., C. Harman, B. Ravit, E. Watson. 2020. The Status and Future of Tidal Marshes in New Jersey Faced with Sea Level Rise. New Jersey Department of Environmental Protection Science Advisory Board. 68 pp.

[28] In-review: Haaf, L., Watson, E.B., Elsey-Quirk, T., Raper, K., Padeletti, A., Maxwell-Doyle, M., Kreeger, D. and Velinsky, D., 2019. Sediment accumulation, elevation change, and the vulnerability of tidal marshes in the Delaware Estuary and Barnegat Bay to accelerated sea level rise. bioRxiv, p.821827.

[29] Weis, J.S., C. Harman, B. Ravit, E. Watson. 2020. The Status and Future of Tidal Marshes in New Jersey Faced with Sea Level Rise. New Jersey Department of Environmental Protection Science Advisory Board. 68 pp.

[30] Richard Lathrop. 2014. Modeling the Fate of New Jersey's Salt Marshes Under Future Sea Level Rise. Center for Remote Sensing & Spatial Analysis, Rutgers University.

[31] Richard Lathrop. 2014. Modeling the Fate of New Jersey's Salt Marshes Under Future Sea Level Rise. Center for Remote Sensing & Spatial Analysis, Rutgers University.

[32] Jacobsen, R. 2019. Rebuilt Wetlands Can Protect Shorelines Better than Walls. Article originally published with the title "Beyond Seawalls" in Scientific America Vol. 320, Issue 4, pp 32-37.

[33] Huang, H., J. M. Winter, E. C. Osterberg, R. M. Horton, and B. Beckage. 2017. Total and extreme precipitation changes over the Northeastern United States. Journal of Hydrometeorology 18:1783–1798.

[34] Castagna, J. 2016. Messages in the sand from hurricane Sandy. Army News Service.

[35] State of New Jersey Office of the State Comptroller. 2021. NJ Sandy Transparency: Funds Awarded by Federal Departments to New Jersey.

[36] Kunreuther, H., S. Wachter, C. Kousky, M. Lacour-Little. 2018. Flood Risk and the U.S. Housing Market. Penn Institute for Urban Research & Wharton Risk Management and Decision Process Center Working Paper. 38 pp.

[37] Becketti, S. 2016. Life's A Beach. Freddie Mac, Economic & Housing Research Insight. 7 pp.

[38] Flavelle, C. 2020. Climate Change Is Transforming the Time-Honored Home Loan. The New York Times Section A, Page 21 of the New York edition.

NEXT STEPS

Jersey City, NJ

DRAFT

New Jersey has been experiencing the impacts of a changing climate and will continue to do so over the coming decades, affecting all aspects of the state's environment, communities, and economy. As directed by Governor Philip D. Murphy's Executive Order 89, the priorities presented in this inaugural edition of *New Jersey's Climate Change Resilience Strategy* establish the basis for policy and action planning action at all levels of government. The continued development of the *Resilience Strategy*, with broad public participation in that process, will determine how well the state adapts to a changing future.

Progressing from the identification of strategies to their implementation via specific actions will be an iterative process that begins now. State agencies, individually and with the Interagency Council on Climate Resilience, will review programs and policies based on the information presented here and in the *Scientific Report on Climate Change*. Agencies will assess their procedures to determine how the actions presented in the *Resilience Strategy* can be applied to their operations and programs. The Department of Environmental Protection, for example, will put forth a comprehensive Climate Action Plan by the end of 2021, which will describe the steps it will take to begin integrating climate considerations into its programs.

"Climate change during the state's planning horizon from today to 2100 will affect all aspects of New Jersey's environment, communities, and economy. The continued development of the Climate Change Resilience Strategy, with broad participation in that process, will determine how well the state adapts to a changing future."

The agencies of the Interagency Council will engage stakeholders when assessing potential operational, policy, and programmatic changes needed to further develop and implement the *Resilience Strategy*. Stakeholders will also have the opportunity to provide new ideas that will refine future planning and implementation of the *Resilience Strategy*. The Interagency Council will ensure that all stakeholders, including residents and those that are not part of traditional stakeholder groups, are aware of and able to provide feedback on the actions that should be taken for a climate-resilient state.

As the inaugural edition of this effort, the *Resilience Strategy* does not represent all of the work that New Jersey will undertake over time to build the state's resilience to climate change. Future editions will include more specific, detailed actions which advance those included here. Through

subsequent editions of the *Resilience Strategy*, the Interagency Council will report to the public its successes, its challenges, and the actions needed to resolve those challenges.

The Interagency Council recognizes the policy and operational changes, and new initiatives that will be needed to accomplish the priorities described throughout this document will all require personnel and financial resources. Understanding the amount of funding needed to implement these actions will require more detailed analysis as specific programs are modified and developed. Thus, the *Resilience Strategy* does not include cost estimates or funding plans for the included actions. The Interagency Council will work with the Governor's Office and Legislature to develop a path forward which will allow equitable implementation of this strategy.

Paulus Hook

Interagency Council on Climate Resilience Next Steps

All of the actions presented in the *Climate Change Resilience Strategy* are vital to confronting New Jersey's climate impacts. However, many of these actions will require a significant amount of time and planning before they can be fully implemented. There are many initiatives currently underway that are parallel to the actions presented here. These include guidance for municipalities to use in resilience planning, the Resilient NJ regional planning program, Economic Recovery Act programs, NJ PACT regulatory modernization, and ongoing education and outreach efforts across the state. Together, these workstreams form the basis for future work of the Interagency Council on Climate Resilience.

The following list includes immediate next steps for the Interagency Council on Climate Resilience to take in the next six to twelve months to accelerate the implementation of the *Climate Change Resilience Strategy*:

- Develop a work plan for Interagency Council on Climate Resilience, including issue-specific working groups
- Coordinate the work of the Interagency Council on Climate Resilience with the Environmental Justice Interagency Council
- Develop agency climate change action plans
- Schedule meetings with local government officials groups
- Conduct broad outreach and engagement with stakeholders and the public

The priorities, strategies, and actions presented in this *Climate Change Resilience Strategy* are the framework around which future discussions will take place. The Interagency Council looks forward to working with New Jerseyans to confront the challenges of building resilience to climate change.

"The priorities, strategies, and actions presented in this Climate Change Resilience Strategy are the framework around which future discussions will take place. The Interagency Council looks forward to working with New Jerseyans to confront the challenges of building resilience to climate change."

Delaware Water Gap

STATE OF NEW JERSEY

CLIMATE CHANGE RESILIENCE STRATEGY

APRIL 2021

DRAFT