Testimony of Professor Clinton Andrews to the Senate Environment and Energy and Assembly Environment and Solid Waste Committees

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Lavallette Municipal Building
1306 Grand Central Avenue
Lavallette, New Jersey

Good morning. My name is Clinton Andrews, and I serve as a Distinguished Professor and direct the Center for Urban Policy Research at Rutgers University's Edward J. Bloustein School of Planning and Public Policy. I am also a faculty advisor to the Rutgers New Jersey Climate Change Resource Center.

Thank you for the invitation to talk about the types of infrastructure that are most susceptible to storm and climate-related hazards, and where investments would be most effective. My focus here is on climate resilient infrastructure investment that will improve the ability for communities to adapt to stresses resulting from a changing climate, while better positioning New Jersey to respond in the future.

First, let me define what I mean by infrastructure. The dictionary definition is that infrastructure consists of the physical and organizational systems that support the rest of the economy and society. It is an enabler of a well-functioning community. Familiar physical infrastructure systems include road networks, electric power grids, and water systems. Equally important are the organizational systems that deliver healthcare, financial liquidity, and education. What counts as infrastructure may change over time. For example, 50 years ago, there was no internet, whereas now our economy can't function without it. Different laws thus vary slightly in their definitions of what counts as infrastructure. I will focus here on a few of the infrastructure systems most in need of public financial support.

A variety of threats may disrupt infrastructure. Some are man-made, such as the cybersecurity attacks currently threatening U.S. water supply systems. Others are natural, such as coastal storms and intense heat waves. We want infrastructure systems to be efficient and effective in normal operation, and resilient in abnormal situations. They should be able to bounce back after adverse events and help the economy and the rest of society adapt to disruptions and changes.

Storm and climate-related hazards are notable disruptions that have long afflicted New Jersey, and they are getting worse. Rutgers scientists have documented adverse trends in coastal flooding, dollar amounts of storm damage, rising sea levels, and more extreme weather events in terms of rainfall intensity, wind, and extreme heat. Coastal jurisdictions bear the brunt of the sea level rise and large storms, whereas riverine jurisdictions suffer from the flooding that follows intense rainfall. Cities are especially vulnerable to extreme heat conditions because air

conditioning is less prevalent in rental housing, and urban heat island effects intensify the experience of heatwaves.

How do these hazards affect infrastructure systems? My colleagues at the New Jersey Climate Change Resource Center have prepared a brief assessment that I attach to my testimony and which I encourage interested parties to explore. Key takeaways include the following:

1. Transportation, energy, water supply, and wastewater disposal have been identified in the *2025 State Plan Infrastructure Needs Assessment* as the infrastructure sectors with the highest infrastructure funding needs for the next five to fifteen years: transportation sector has an estimated investment need of $65.7 billion through 2030; the energy sector needs range from $91 billion - $194 billion over the next decade; and water supply and wastewater treatment need over $12 billion and $11.75 billion, respectively, over the next twenty years. These projected investment values do not consider climate change impacts, which would significantly increase overall investment needs.
2. There is a clear case for investment in climate-resilient infrastructure in New Jersey with an emphasis on the transportation; water resources and flood management; and community, education and cultural infrastructure sectors. However, these scarce public funds will be better used if investments are informed by basic planning considerations. For example, it is possible to reduce risk to investments in infrastructure by ensuring that it directs residences and businesses to lower-risk areas and avoids investments in areas that are highly exposed to coastal flooding and sea level rise.
3. Climatic factors are already increasing physical deterioration rates and putting stress on our infrastructure. The infrastructural maintenance and repair needs identified today may change as technological advances make some infrastructure types obsolete and shift statewide priorities. Because environmental conditions are also evolving, it may be helpful to apply adaptive management principles toward plans for maintenance, repair, mitigation, and future investments in infrastructure. This implies investing incrementally in flexible, adaptable solutions as adequate information becomes available.
4. There are sound reasons to invest public funds in more risk-resilient infrastructure. It is a systemic risk reducer whose benefits accrue to all sectors of society. The public good argument is especially strong when the infrastructure element is critical, such as a services hub or transportation corridor; when the distribution of impacts is disparate and affects vulnerable members of society; and when the infrastructure helps steer private decision makers toward lower-risk choices.
5. Infrastructure investments typically provide a solid public payoff, yielding returns that are a multiple of the public investments. Investing in climate resilience can yield a triple dividend, by: (1) avoiding losses; (2) inducing economic or development benefits; and (3) realizing additional social and environmental benefits that accrue independently of how climate scenarios unfold. The returns are especially compelling for transportation assets,

flood protection, and essential public services associated with electric grids, stormwater, wastewater, and drinking water treatment facilities.

6. There are extant programs in New Jersey for (1) community-based climate change resilience (e.g., Resilient NJ, State and County Hazard Mitigation Planning, New Jersey Community Hazard Assistance Mitigation Program, Resilient Communities Program), (2) land preservation (e.g., Green Acres, Blue Acres, Farmland Preservation), (3) water (e.g., New Jersey Water Bank, New Jersey Clean Stormwater and Flood Reduction Fund), and (4) transportation (e.g., Complete & Green Streets For All; New Jersey Department of Transportation's Framework For Managing Sediment in the Back Bays of New Jersey; North Jersey Transportation Planning Authority's Resilience Improvement Plan, NJ Transit's Sustainability Plan). These provide an excellent foundation upon which to build further infrastructure investments. However, there is a need for a dedicated, sustained source of funding, which does not yet exist, for climate resilient planning and infrastructure in New Jersey. Initiatives are funded through a patchwork of federal and state resources and are often centered on other goals (e.g., carbon sequestration, water quality, habitat restoration). Such efforts are yet not focused on maintaining a thriving business district, maintaining property ratables or preventing damage before an event such as a storm – all of which are at the center of local concerns and which impact affordability. Federal sources of funds are no longer as reliable as they once were.
7. Good models exist for efficiently and effectively delivering financing for more resilient infrastructure. The New Jersey Transportation Bank provides precedent for a New Jersey revolving loan infrastructure financing program that does not rely on federal funds and is supported through state bond legislation. Other states, such as New York and Rhode Island, have successfully implemented dedicated funding for resilient infrastructure initiatives. These initiatives are often preceded by planning efforts, with Massachusetts and Minnesota offering instructive examples. Public infrastructure investments can be augmented and leveraged through partnerships with foundations and the private sector.

In summary, there is strong evidence for the efficacy of strategies that adapt infrastructure to contend better with climate change, while directing development away from floodplains and reducing the difficulties experienced by vulnerable subgroups. Appropriate, planning-informed models for financing these improvements exist, and New Jersey would benefit from their adoption today.

To the committee chairs and members, thank you again for the chance to talk with you today about this timely and important issue.

Understanding Infrastructure Susceptibility to Storm and Climate-Related Hazards and Effective Investments

Attachment to the Testimony of Professor Clinton Andrews to the Senate Environment and Energy and Assembly Environment and Solid Waste Committees

August 13, 2026

RUTGERS–NEW BRUNSWICK
New Jersey Climate Change Resource Center

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Summary

The New Jersey Climate Change Resource Center at Rutgers University prepared this background document to assist the New Jersey Legislature in understanding what types of infrastructure are most susceptible to storm and climate-related hazards, and where investments would be most effective. Our focus here has been on climate resilient infrastructure investment that will improve the ability for social and ecological systems to absorb and adapt to shocks and stresses resulting from a changing climate, while better positioning New Jersey to respond in the future. This focus aligns with resilience concepts from both the State of New Jersey Climate Change Resilience Strategy and the National Academy of Sciences.

Climate change-related hazards that impact New Jersey include flooding from sea-level rise, increased precipitation, and storms; extreme temperatures; wildfire; drought; coastal erosion; and severe weather. Climate change-related hazards can and do occur simultaneously. The compound effects of, for example, storm flooding with extreme heat, are events that are more likely to occur moving further into the century. From 1980-2024, there were 75 confirmed weather/climate disaster events with losses exceeding $1 billion each to affect New Jersey. These events included 7 drought events, 4 flooding events, 1 freeze event, 32 severe storm events, 13 tropical cyclone events, and 18 winter storm events. About 60% of the confirmed climate disasters have occurred since 2010.

To understand what infrastructure is at risk, we first defined infrastructure. We looked to physical infrastructure and non-physical systems rooted in the infrastructure sectors identified in the New Jersey State Development and Redevelopment Plan Infrastructure Needs Assessment and the FEMA Community Lifeline sectors within the 2024 State Hazard Mitigation Plan.

To get a sense of what is at risk, we provided quantitative analyses of near-term and long-term flooding impacts to critical infrastructure under various climate scenarios demonstrating that coastal inundation poses a significant threat to a large number of properties, facilities, and roadways/bridges, while statewide flooding that includes inland areas shows an even larger proportion at risk. We noted qualitative impacts related to the increasing number of extreme heat days and the strain extreme heat puts on infrastructure. We also reported a large number of properties and a significant value statewide are at Very High Exposure or greater of potential wildfire hazard, posing a threat to community and economic resilience in some areas. While a smaller number of critical facilities are at risk to wildfire exposure when compared to other climate hazards such as flooding, facilities such as those that contain or manage hazards materials are of specific

concern due to the possibility of toxic chemicals being released into the atmosphere and threatening nearby communities.

To better assess what might be the most worthwhile of investments, we reviewed a representative sample of fifteen climate change related regional and municipal planning and assessment documents prepared through the Resilient NJ program, the 2024 State Hazard Mitigation Plan (HMP), and several county hazard mitigation plans. This comparison across plans allowed us to determine what infrastructure sectors were most prevalently represented by mitigation project types, and impacts identified across the plans, as an indicator for the infrastructure sectors considered most at risk. We chose this content analysis approach given that these documents were prepared by recognized experts, included extensive public engagement, and are a broad representation of infrastructure impacts across New Jersey. Our review finds these sectors that stand out: Transportation, Water Resources and Flood Management; and Community, Education, and Cultural Infrastructure.

Our assessment did not find the electricity sector mitigation actions as prominent in this review perhaps because private companies are not beholden to carry out actions identified in these plans and these private utilities (which serve the majority of New Jersey utility customers) are required to develop and implement plans to meet, sustain and improve reliability; note they can rate-base their resiliency measures under the NJ Board of Public Utilities' Infrastructure Investment Program for Utilities.

Our assessment provided additional context, concepts, and supporting analyses regarding important factors to consider regarding infrastructure needs, noting how climate projections may change, integration of adaptive management principles, the economic risk of climate change, the benefits of climate resilience investment, and resources. We also highlight key New Jersey programs that identify and address infrastructure needs with a climate nexus. Lastly, we provide some concluding analyses and thoughts for consideration (including examples and models from within New Jersey as well as other states to illustrate concepts) related to the need for investment and sustaining a climate resilience framework for New Jersey including diversification of funding strategies for infrastructure resilience, accounting for the costs of climate resilience in infrastructure, sustaining New Jersey's climate resilience administrative infrastructure, and strengthening resilience in infrastructure investment.

Below is a summary of Key Takeaways.

Key Takeaways

◊ There is a clear case for investment in climate-resilient infrastructure in New Jersey with an emphasis on Transportation; Water Resources & Flood Management; and Community, Education, & Cultural Infrastructure sectors.

◊ Climate-resilient infrastructure functions as a systemic risk reducer and should be considered a public good because it provides benefits that accrue to all sectors of society.

◊ Considerations in prioritizing infrastructure investment can include diversifying assets to increase network resilience, decentralizing and using new technologies, and working across systems to capture synergies and understand complex interdependencies and potential domino effects between infrastructure and sectors.

◊ We suggest that priorities consider minimizing risk by investments in infrastructure that will direct residences and businesses to low-risk areas as well as avoiding investments in areas that are highly exposed to coastal flooding and sea level rise.

◊ In addition to residential and commercial property threats of climate change, the most pressing economic threats to the state from climate change include increasing vulnerability of New Jersey's infrastructure including transportation assets, essential public health services (grids, stormwater, wastewater, drinking water treatment facilities) and gray and green infrastructure for flood protection.

◊ Investing in climate resilience yields a triple dividend: 1) avoided losses; 2) induced economic or development benefits; and 3) additional social and environmental benefits where 2 and 3 accrue regardless of whether the actual climate risk materializes, can exceed the value of avoided losses, and can generate project benefit-cost ratios greater than 1 even absent the value of avoided losses.

◊ There are methods and approaches to guide evaluation where cost-effective measures under various climate hazard scenarios can be applied (e.g., those developed by the US DOT Volpe National Transportation Systems Center and the Port Authority of NY and NJ).

◊ There are extant programs in New Jersey for (1) community-based climate change resilience (e.g., Resilient NJ, State and County Hazard Mitigation Planning, NJ

Community Hazard Assistance Mitigation Program, Resilient Communities Program); (2) land preservation (Green Acres, Blue Acres, Farmland Preservation); (3) water (e.g., NJ Water Bank, NJ Clean Stormwater and Flood Reduction Fund); and (4) transportation (e.g., Complete & Green Streets For All; NJ Department of Transportation's Framework For Managing Sediment in the Back Bays of New Jersey; North Jersey Transportation Planning Authority's Resilience Improvement Plan, NJ Transit's Sustainability Plan) that provide an excellent foundation upon which to build further infrastructure investments.

◊ There is a need for, yet currently no dedicated, sustained source of funding for climate resilient planning or infrastructure in New Jersey.

◊ Current initiatives and projects are funded through a patchwork of federal and state resources, often centered on other goals (e.g., carbon sequestration, water quality, habitat restoration), yet not focused on maintaining a thriving business district, maintaining ratables or preventing damage before a climate related event such as a storm – all of which are at the center of local community asks and which impact affordability.

◊ Federal sources of funds are no longer as reliable as they once were, including diversion of federal funds for Congressional earmarks and proposed elimination of federal funds for state revolving loan programs.

◊ The New Jersey Transportation Bank provides precedent for a New Jersey revolving loan infrastructure financing program that does not rely on federal funds and is supported through state bond legislation which authorizes the New Jersey Transportation Trust Fund.

◊ Other states (e.g., New York and Rhode Island) have successfully implemented dedicated funding for resilient infrastructure initiatives.

◊ Public vehicles to finance infrastructure investment can be augmented and leveraged through partnerships with foundations and the private sector.

◊ For long-term planning, it is important to have a fuller understanding of the State's infrastructure needs that account for climate resilience, but that should not be an impediment to moving forward today.

◊ Other states (e.g., Massachusetts, Minnesota, and Rhode Island) have developed comprehensive approaches to evaluating resilience funding needs that can be instructive for New Jersey.

◊ Given the vulnerability to climate change that New Jersey faces, the State can consider mitigating its own vulnerability to addressing this issue into the future through legislative authority to sustain an administrative infrastructure and framework commensurate with the goals of Executive Order 89. It might also consider the role of advisors to, or non-state agency representation on, its Interagency Council.

◊ There is high evidence in the planning literature to support strategies to: adapt infrastructure to contend with climate change, especially impacts that disproportionately affect vulnerable populations; to strictly limit development in floodplains; and to implement mandatory flood mitigation standards in new construction and restrict development in high-risk zones.

◊ Infrastructure investments can be coupled to conditions to ensure they are resilient to climate change hazards by limiting their development in high-risk areas (for example, areas prone to flooding, storm surge, or inundated by sea level rise over their lifetime); providing design guidelines that account for climate risk; and encouraging investments that will direct residences and businesses to low-risk areas.

1. New Jersey Climate Change

Commonly occurring climate change related hazards that impact New Jersey include flooding from sea-level rise, increased precipitation, and storms; extreme temperatures; wildfire; drought; coastal erosion; and severe weather.[1] Climate data for New Jersey include the following:

Temperature

- average annual temperatures in New Jersey have increased by nearly 4.0 °F since the end of the 1800s and since 1970, New Jersey average temperatures have

[1] New Jersey Office of Emergency Management. 2024. State of New Jersey All-Hazards Mitigation Plan: State Risk Assessment. https://njsp.njoag.gov/njoem/wp-content/uploads/2025/06/06_Section_4_1_Risk-Assessment-Overview.pdf

increased at a rate of 0.66 °F/ decade the equivalent rate of 6.6 °F/century, indicating that warming has been accelerating in the state;
- projections of warming into the future under a moderate greenhouse gas emissions scenario are 3.7 to 6.2°F by 2100 above a 1991-2020 average;

Sea-Level Rise

- sea level in Atlantic City rose about 1.5 feet from 1912 to 2021;
- by 2050 the likely range of sea-level rise is 0.9 to 1.7 feet, but if we include rapid ice sheet loss this range is extended to 1.9 feet;
- under an intermediate greenhouse gas emissions scenario, the likely range of sea-level rise is 2.2 to 3.8 feet by 2100 and extends to 4.5 feet if we include rapid ice sheet loss;

Precipitation

- decadal average precipitation in NJ increased roughly 3-5 inches or 7% since early 1900s;
- the Northeast is projected to become wetter and experience greater precipitation variability by the middle and end of the 21st Century. New Jersey projections under moderate emission scenario find that mean annual precipitation for NJ will be 3-13% higher than the NJ 2001-2020 average by end of the century;
- the Northeast has seen a 49% increase in the number of days with more than 2 inches of rainfall compared to the long-term 1958–2022 average and an 84% increase in days with more than 4 inches of rainfall compared to the long-term 1958 to 2022 average. The likely trend throughout the rest of the century is for large precipitation events (such as the 100-yr 24-hour event) in New Jersey to increase in both frequency and the amount of precipitation;

Tropical Cyclones and Nor'Easters

- tropical cyclone frequency has increased over the North Atlantic since the 1980s. The overall intensity (i.e., wind speed) that Atlantic tropical cyclones achieve, and the rate at which they intensify, has also increased in recent decades,
- although absolute changes in future tropical cyclone frequency remain uncertain, there is greater confidence that the proportion of very intense tropical cyclones (Category 4 and 5) will increase in a warmer world;
- extratropical cyclones (ETCs), called nor'easters along the US Atlantic coast, are large storms that form outside of the tropics and are typically larger than tropical cyclones and affect coastal New Jersey more frequently than tropical cyclones. As with tropical cyclones, the precipitation intensity of ETCs has been increasing over

time. However, long-term historical trends in ETC frequency, intensity, and trajectory remain an area of active research; currently, there is no definitive consensus regarding such changes. Likewise, predictions of long-term trends in ETC changes are limited and an active research area.[2] [3]

It is important to note that climate change-related hazards can and do occur simultaneously. The compound effects of for example, storm flooding with extreme heat, are events that are more likely to occur moving further into the century.[4] [5]

Fiscal Impacts

From 1980-2024, there were 75 confirmed weather/climate disaster events with losses exceeding $1 billion each to affect New Jersey. These events included 7 drought events, 4 flooding events, 1 freeze event, 32 severe storm events, 13 tropical cyclone events, and 18 winter storm events. About 60% of the confirmed climate disasters have occurred since 2010. [6]

2. Defining Infrastructure

Infrastructure has historically referred to longer-lived, capital intensive systems and facilities, such as roads and bridges. In the economic sense, infrastructure includes both physical structures and non-physical systems that undergird a well-functioning economy.[7] What is considered "infrastructure" changes over time as well due to the shifting needs of society and emerging technologies. This report considers both definitions in order to fully consider the impacts of climate change on infrastructure. The impacts of climate change

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[2] Sweeney, M., Shope, J., Broccoli, A., Gerbush, M., Kaplan, M., Robinson, D., Herb, J. & Cornish, A. 2026. State of the Climate: New Jersey 2025. Rutgers, The State University of New Jersey, New Brunswick, NJ. DOI: 10.7282/00000624

[3] Kopp, R. E., A. Broccoli, G. Carleton, S. Dangendorf, R. DeConto, R. Frederiks, A.J. Garner, E. GroverKopec, L. Haaf, B. Hamlington, N. Lin, J. Lorenzo-Trueba, J. Miller, D. Robinson, G. Vecchi, T. Wahl, J. Walker, J.M. Barr, J. Shope, D.K. Apoznanski, P. Kumar, L. Marxen, A. Spector, K. O'Neill, L. Auermuller, and M. Kaplan.

[4] Singh, D., A.R. Crimmins, J.M. Pflug, P.L. Barnard, J.F. Helgeson, A. Hoell, F.H. Jacobs, M.G. Jacox, A. Jerolleman, and M.F. Wehner, 2023: Focus on compound events. In: *Fifth National Climate Assessment*. Crimmins, A.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. U.S. Global Change Research Program, Washington, DC, USA. https://doi.org/10.7930/NCA5.2023.F1. Available at https://nca5.climate.us/chapter/focus-on-1

[5] The Pew Charitable Trusts. September 2024. Climate Change Poses Risks to Neglected Public Transportation and Water Systems. https://www.pew.org/en/research-and-analysis/issue-briefs/2024/09/climate-change-poses-risks-to-neglected-public-transportation-and-water-systems

[6] National Centers for Environmental Information. 2024. Billion-Dollar Weather and Climate Disasters: New Jersey Summary. https://www.ncei.noaa.gov/access/billions/state-summary/NJ

[7] Congressional Research Service. Infrastructure and the Economy. 2026. https://www.congress.gov/crs-product/R46826

will continue to affect both physical and non-physical infrastructure and systems; altering what infrastructure becomes obsolete or newly critical over time.[8]

Infrastructure Sector Typology Development

To more concisely refer to different types of infrastructure, we developed a typology of eight infrastructure sectors from a crosswalk of the 2025 New Jersey State Development and Redevelopment Plan (The State Plan) Infrastructure Needs Assessment (INA), and the 2024 State Hazard Mitigation Plan (SHMP). While we recognize there are county and municipal infrastructure needs and associated climate impacts, for purposes of developing a typology, cross walking these statewide plans captures sectors that would be included in county and local plans.

In framing infrastructure, we first refer to the December 2025 INA required under the New Jersey State Planning Act (N.J.S.A. 52:18A-196 et. seq), prepared by Rutgers planners for the New Jersey State Planning Commission and New Jersey Department of State Office of Planning Advocacy.[9] Pursuant to the statute, the INA shall provide information on present and prospective conditions, needs and costs with regard to State, county and municipal capital facilities, including water, sewerage, transportation, solid waste, drainage, flood protection, shore protection and related capital facilities. The State Plan defines infrastructure as "those Capital Facilities and Land Assets under public ownership, or operated or maintained for public benefit, that are necessary to support development and redevelopment and to protect public health, safety and welfare" and is defined in the New Jersey State Planning Act (N.J.S.A. 52:18A-196 et. seq.) as state, county and municipal capital facilities, including water, sewerage, transportation, solid waste, drainage, flood protection, shore protection and related capital facilities."[10] The INA addressed these seven statutorily required infrastructure systems as well additional infrastructure systems that include: energy; telecommunications; farmland retention; public recreation and open space lands; public healthcare; public education; higher education; public libraries; arts,

[8] The World Bank. 2023. Definitions and classifications of infrastructure hugely influence investment decisions and the ability to close the infrastructure gap. https://www.gihub.org/news/definitions-and-classifications-of-infrastructure-hugely-influence-investment-decisions-and-the-ability-to-close-the-infrastructure-gap/

[9] Rutgers University. 2025. Final Infrastructure Needs Assessment: 2024-2030. New Jersey State Development and Redevelopment Plan. Prepared for the New Jersey State Planning Commission and the New Jersey Office of Planning Advocacy. https://www.nj.gov/state/bac/planning/documents/update-to-state-plan/njsdrp_ina_dec_2025_final.pdf

[10] New Jersey State Planning Commission. 2025. The New Jersey State Development and Redevelopment Plan. New Jersey Department of State: Trenton, NJ. https://www.nj.gov/state/bac/planning/documents/update-to-state-plan/sdrp_2025.pdf

culture, and historic resources; public safety, justice and corrections; public administration and human services; publicly subsidized affordable housing.

As noted in the 2001 INA, investment in capital facilities and other infrastructure is one of the most powerful tools available to implement comprehensive plans for development and redevelopment, finding that the New Jersey State Planning Act recognizes the importance of infrastructure by promoting development where infrastructure capacity exists or may be readily provided and discouraging development where capacities are limited.[11]

As a cross check to ensure that emergency response would also be supported through addressing these infrastructure needs, we then compared the INA infrastructure sectors with FEMA Community Lifeline sectors that are used within hazard mitigation planning, finding that indeed the two comport. Within the SHMP, infrastructure is often referred to as "critical infrastructure" and categorized under FEMA Community Lifeline Sectors. Community Lifelines are the "most fundamental services in the community that, when stabilized, enable all other aspects of society to function. A lifeline enables the continuous operation of critical government and business functions and is essential to human health and safety or economic security."[12] There are eight sectors of Community Lifelines: Safety and Security; Food, Hydration, Shelter; Health and Medical; Energy; Communications; Transportation, Hazardous Materials; and Water Systems.[13] The data most often used within these sectors to identify infrastructure type and location come from the Department of Homeland Security (DHS), Homeland Infrastructure Foundation-Level Data (HIFLD).[14] The HIFLD data is used in risk assessment and analyses within hazard mitigation planning.

The eight infrastructure sectors identified are included in Table 1 below. The first column identifies the overall sector, and the second column includes the more detailed description of infrastructure that falls under each category.

[11] New Jersey State Planning Commission. 2001. The New Jersey State Development and Redevelopment Plan Infrastructure Needs Assessment. https://nj.gov/state/bac/planning/documents/154-infrastructure-needs-assessment-030101.pdf

[12] Federal Emergency Management Agency, Department of Homeland Security. 2024. Community Lifelines. https://www.fema.gov/emergency-managers/practitioners/lifelines

[13] New Jersey Office of Emergency Management. 2024. State of New Jersey 2024 All-Hazard Mitigation Plan. https://njsp.njoag.gov/njoem/programs/hazard-mitigation/hazard-mitigation-grant-program/hazard-mitigation-plans/2024-mitigation-plan/

[14] US Department of Homeland Security. 2025. Homeland Infrastructure Foundation-Level Data (HIFLD). https://www.dhs.gov/gmo/hifld

Infrastructure Sector	Description
Transportation	*Roads, bridges, transit, rail, aviation, maritime; FEMA Transportation Lifeline – Aviation facilities, bus terminals, ferry terminal, hurricane evacuation routes, intermodal freight air to truck, intermodal freight marine roll on roll off, intermodal freight rail TOFC/COTFC, navigable waterway nodes, NJDOT facilities, NJ transit facilities, port facilities, public transit stations.*
Energy	*Electric generation, transmission, distribution, fuels; FEMA Energy Lifeline – biodiesel plants, electric substations, EPA FRS power plants, ethanol transloading facilities, natural gas compressor stations.*
Communications and Information Systems	*Telecommunications; Broadband, wireless, emergency communications; FEMA Communications Lifeline (antenna structures, cellular towers, communication centers, FM transmission towers, land mobile broadcast towers, land mobile private transmission towers, microwave service towers, paging transmission towers, tv analog station transmitters, tv digital station transmitters.*
Water Resources and Flood Management	*Water Supply; Wastewater Infrastructure; Stormwater Management; Flood Protection; Shore Protection; FEMA Water Systems Lifeline – potable water infrastructure (intake, treatment, storage, distribution), wastewater management (collection, storage, treatment, discharge).*
Food Systems and Working Lands	*Farmland Retention; Agricultural production; FEMA Food, Hydration & Shelter Lifeline (Agriculture) - public refrigerated warehouses.*
Housing, Health, and Human Services	*Publicly Subsidized Affordable Housing; Public Healthcare; Human Services; FEMA Food, Hydration & Shelter + Health & Medical Lifelines – VHA medical facilities, urgent care facilities, public health*

	departments, pharmacies, nursing homes, hospitals, hospice care, federally qualified health centers, EMS stations, childcare centers.
Public Safety	*Public Safety; Justice & Corrections; Public Administration; Emergency Management; FEMA Safety & Security Lifeline – Local EOCs, local law enforcement, prison boundaries, fire stations, FBI field offices, EPA facilities.*
Community, Education, and Cultural Infrastructure	*Public Education; Higher Education; Libraries; Arts/Culture/Historic Resources; Recreation/Open Space; Primarily FEMA Safety & Security (government/community services), with Health & Medical and Communications support functions - colleges and universities, private schools, public schools, supplemental colleges.*

Table 1. Eight infrastructure sectors identified from crosswalk of the 2025 State Plan and 2024 State Hazard Mitigation Plan.

3. Climate Impacts on New Jersey Critical Infrastructure – Data and Planning/Emergency Response Tools

The Rutgers New Jersey Climate Change Resource Center's (NJCCRC) mission is to create and support the use of impartial and actionable science to advance government, public, private, and nongovernmental sector efforts to adapt to, and mitigate, a changing climate. As part of that mission, the Center creates planning tools under the NJADAPT platform[15] to provide practical support for addressing climate change in New Jersey. The data analyses below have been developed as part of that platform and are available through tool such as NJ Haz Adapt[16] which is designed to support hazard mitigation planning efforts statewide.

Flood Impacts

The flood impacts to New Jersey infrastructure under future flood conditions have been analyzed by the Rutgers NJCCRC. The analyses presented examine the impacts at 2 ft and 4 ft of coastal flooding, and the FEMA 1% annual chance flood areas plus an additional 3 ft that represents the Design Flood Elevation of the NJDEPs Inland Flood Protection Rule and

[15] Rutgers University. NJ Climate Change Resource Center's NJADAPT. https://njclimateresourcecenter.rutgers.edu/nj-adapt/

[16] Rutgers University, NJ Climate Change Resource Center. 2026. NJ Haz Adapt. https://njhazadapt.rutgers.edu

corresponds with reported flood depths from Hurricane Ida.[17] The 2 ft coastal inundation dataset[18] was developed by Rutgers and represents both the projected sea-level rise for New Jersey by 2050 as well as a close approximation of nuisance minor high-tide flooding that occurs in many coastal areas of the state.[19] The 4 ft coastal inundation dataset[20] was developed by Rutgers and represents the projected sea-level rise for New Jersey by 2100 based on the high-end of the likely range under an intermediate emissions scenario.[21] The Inland Design Flood Elevation[22] dataset was developed by Rutgers to provide a planning dataset for communities across the state (inland and coastal) to approximate the areas falling within the NJDEP Inland Flood Protection Rule. Rutgers examined the potential impact of these three flood scenarios on the critical infrastructure, land parcels, roadways, and bridges statewide and are presented below. It should be noted that the below analysis is a desktop analysis using available geospatial data and may not account for flood adaptation or mitigation actions that have already occurred on properties or at specific locations.

Critical Infrastructure and Flooding

As previously noted, critical infrastructure facility data are made available through the U.S. Office of Homeland Security's Homeland Infrastructure Foundation-Level Data (HIFLD).[23] This dataset is often referred to as 'lifeline sectors' and provides facility data across multiple types such as communications, energy, financial, food/water/shelter, hazardous materials, health, safety and security, and transportation. These facilities are focused on by state and county Hazard Mitigation Plans (HMPs) and municipal Climate Change

[17]New Jersey Department of Environmental Protection. 2023. Inland Flood Protection Rule – Lessons from Tropical Storm Ida https://dep.nj.gov/inland-flood-protection-rule/lessons/
[18] Rutgers University, NJ Climate Change Resource Center. 2026. NJ 2ft. Coastal Inundation Depth. https://arcg.is/0uf4Pf2
[19] NOAA. Tides & Currents, Annual High Tide Flooding Outlook, Atantic City, NJ. https://tidesandcurrents.noaa.gov/high-tide-flooding/annual-outlook.html?station=8534720
[20] Rutgers University, NJ Climate Change Resource Center. 2026. NJ 4ft. Coastal Inundation Depth. https://arcg.is/G1q9D
[21] Kopp, R. E., A. Broccoli, G. Carleton, S. Dangendorf, R. DeConto, R. Frederiks, A.J. Garner, E. Grover-Kopec, L. Haaf, B. Hamlington, N. Lin, J. Lorenzo-Trueba, J. Miller, D. Robinson, G. Vecchi, T. Wahl, J. Walker, J.M. Barr, J. Shope, D.K. Apoznanski, P. Kumar, L. Marxen, A. Spector, K. O'Neill, L. Auermuller, and M. Kaplan. New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2025 Science and Technical Advisory Panel. Rutgers, The State University of New Jersey. Prepared for the New Jersey Department of Environmental Protection. Trenton, New Jersey. https://njclimateresourcecenter.rutgers.edu/wp-content/uploads/2025/11/NJ-Rising-Seas-and-Changing-Coastal-Storms-11-2025.pdf
[22] Rutgers University, NJ Climate Change Resource Center. 2026. Rutgers NJ Inland Design Flood Elevation (FEMA 1% Chance Annual Flood Plus 3 Feet) Data Package. https://arcg.is/1CzGia4
[23] US Department of Homeland Security. 2025. Homeland Infrastructure Foundation-Level Data (HIFLD). https://www.dhs.gov/gmo/hifld

Related Hazard Vulnerability Assessments (CCRHVAs) as critical facilities when considering climate risks. A selection of statewide critical facility types are presented below with the number potentially impacted by the three different flood scenarios.

Table 2 - Selected Statewide Critical Infrastructure Potentially Impacted by Flood Scenarios				
Facility Type	Total Statewide	2 ft Coastal Inundation	4 ft Coastal Inundation	Inland Design Flood Elevation
Energy Facilities				
Power Plants	325	1	4	82
Electric Substations	487	10	39	171
Health Facilities				
Pharmacies	2,016	5	25	330
Nursing Homes	610	0	1	52
Hospitals	149	0	0	14
Emergency Medical Services	1,267	6	35	255
Safety and Security Facilities				
Public Schools	2,616	3	22	240
Private Schools	775	1	5	93
Local Law Enforcement	624	2	12	112
Transportation Facilities				
Public Transit Stations	239	0	3	70
Port Facilities	504	317	370	496
Hazardous Materials Facilities				
Solid Waste Landfills	75	1	3	26
Toxic Release Inventory Facilities	1,811	49	135	708

Land Parcels and Flooding

Understanding the flood risk to land parcels can help identify potential impacts to housing, commercial businesses, industrial facilities, and public properties that can disrupt both community and economic activity. New Jersey's MOD-IV Tax Record (NJ Division of Taxation[24] and Rutgers University[25]) and New Jersey Statewide Parcels[26] datasets allow for the analysis of different flood scenarios and their potential impacts to different property

[24] NJ Department of the Treasury, Division of Taxation. 2026. Property Assessment List (MODIV). https://www.nj.gov/treasury/taxation/lpt/statdata.shtml

[25] Rutgers University. 2026. N.J. MOD IV Historical Database. https://modiv.rutgers.edu/

[26] NJ Office of GIS. 2026. Parcels Composite of NJ. https://njogis-newjersey.opendata.arcgis.com/documents/newjersey::parcels-composite-of-nj-download/about

types across the state.[27] MOD-IV is the statewide tax record database that contains information on property class, tax valuation and other property attributes for all 3+ million properties statewide. The New Jersey Statewide Parcels dataset is generated by the NJ Office of GIS and is compiled from county tax maps and updated to best align with the latest MOD-IV data release. These datasets have been modified by the Rutgers NJCCRC to allow for more accurate parcel and ownership representation. The table below highlights the potential impacts of the three flood scenarios on parcels with at least 50% of their land area inundated by property class using data from the 2024 tax year.

Table 3 - Land Parcels Potentially Impacted (50%+ Area) by Flood Scenarios				
Property Class	Total Parcels Statewide	2 ft Coastal Inundation	4 ft Coastal Inundation	Inland Design Flood Elevation
Vacant Land (1)	153,805	6,843	12,222	44,768
Residential (2)	2,531,316	16,763	93,935	430,576
Farm (3A & 3B)	32,874	424	625	4,271
Commercial (4A)	118,795	1,336	4,421	26,272
Industrial (4B)	16,268	254	927	5,524
Apartments (4C)	16,905	25	274	3,007
Public/Non-Profit School (15A & 15B)	6,940	38	116	936
Public Municipal (15C)	119,690	7,574	11,537	42,019
Church/Charitable/ Cemeteries (15D & 15E)	17,982	80	410	2,519
Other Public (15F)	42,768	696	2,279	10,788

The MOD-IV data also includes property tax valuation data of land and improvements that allow for an estimation of economic impact from flooding to properties statewide. The modified Rutgers dataset used in this analysis incorporates the municipal level equalization ratios developed by the NJ Division of Taxation to equalize property and improvement values to allow for statewide aggregations and comparisons. The table below highlights the value of property improvements (structures) potentially at risk from the three flood scenarios on parcels with at least 50% of their land area inundated by property class for the 2024 tax year.

[27] Marxen, L., A. Spector, J. DeLura, K. Reddy, and M. Kaplan. (2025). Current and Future Flood Exposure to New Jersey Properties and Associated Assessed Property Value at Risk. Rutgers University. https://doi.org/10.7282/00000502

Table 4 - Value of Improvements[28] Potentially Impacted (50%+ Area) by Flood Scenarios				
Property Class	Total Improvement Value Statewide ($M)	2 ft Coastal Inundation ($M)	4 ft Coastal Inundation ($M)	Inland Design Flood Elevation ($M)
Residential (2)	$841,757	$5,604	$35,549	$153,402
Farm (3A)	$1,830	$5.7M	$10.3	$243.8
Commercial (4A)	$146,253	$588.6	$2,560	$34,848
Industrial (4B)	$58,454	$940.5	$3,813	$20,887
Apartments (4C)	$57,955	$121.8	$560.3	$12,744
Public/Non-Profit School (15A & 15B)	$56,336	$44.9	$420.9	$5,490
Public Municipal (15C)	$41,086	$767.8	$1,643	$11,304
Church/Charitable/ Cemeteries (15D & 15E)	$24,188	$35.8	$269.1	$3,142
Other Public (15F)	$32,822	$331.4	$1,039	$10,982

Roadways and Bridges and Flooding

Roadway flood inundation can impede travel to work, the distribution of goods, public access to essential services, and emergency response operations. Knowing where and when roads may flood is essential for emergency planning as well as the implementation of the infrastructure upgrades necessary for climate change adaptation to coastal flooding. For this analysis, roadway and bridge surface elevations were estimated from a statewide digital surface model (DSM) created by the NJCCRC using the most recent publicly available light detection and ranging (LiDAR) data as of April 23, 2024 combined with statewide road centerline data and land use/land cover data.[29] The table below provides statewide summaries of the miles of roadway and number of bridges potentially impacted under the three flood scenarios.

[28] Vacant Land (1) and Farmland Assessed Land (3B) are land only with no improvements and therefore have no improvement value.

[29] DeLura, J. (2026). Current and Future Coastal Flood Inundation of Roadways in New Jersey. Rutgers University. DOI: 10.7282/00000651. https://njclimateresourcecenter.rutgers.edu/resources/current-and-future-coastal-flood-inundation-of-roadways-in-new-jersey/

Table 5 - Roadways and Bridges Potentially Impacted by Flood Scenarios				
	Total Statewide	2 ft Coastal Inundation	4 ft Coastal Inundation	Inland Design Flood Elevation
Roadways (Miles)	49,064	267	1,205	6,949
Bridges (Number)	3,197	43	113	1,835

Emergency Preparedness and Response Tools

In addition to the NJADAPT platform's tools that support planning for climate hazards and impacts, other units at Rutgers are currently working with state agency partners to develop storm forecast, emergency response and storm post-cast modeling to better protect and understand the near-term impacts to critical infrastructure and people across the state.

The Rutgers Flood Resilience Lab[30] is one such unit that covers the full chain of climate-driven physical risk analysis, from atmospheric and hydrologic hazard to high-resolution exposure of buildings and infrastructure, to operational forecasting and decision-support, bridging advanced science, data-driven modeling, and the practical realities of public-sector decision making. Projects that support state agencies include:

- Terrestrial LiDAR mapping and analysis of buildings and infrastructure within the New Jersey 500-Year floodplain providing elevation data of the lowest living floor for residential buildings for more accurate flood impact and damage modeling of flood events.
- Early flood warning systems at Hoboken Terminal using a full-scale 3D model and for Elizabeth using a city-scale digital twin that provide comprehensive flood forecasting and infrastructure impact assessments.
- The CITADEL system which provides a multi-scale digital twin for New Jersey composed of component digital twins at the facility, city, and state scales, each coupling flood hazard and impact models to support disaster management functions such as early flood warning systems, now- and post-cast flood modeling, and risk communication.

Impacts of Flooding

The analyses provided above illustrates the threat to New Jersey critical infrastructure from both near-term and long-term flood risk. Coastal inundation poses a significant threat to a large number of properties, facilities, and roadways/bridges, while statewide flooding that includes inland areas shows an even larger proportion at risk. Climate change is expected

[30] See Appendix for more details about the Rutgers Flood Resilience Lab.

to increase both the frequency and intensity of storm events and high tide flooding only exacerbating the risk posed to critical infrastructure. Numerous tools have been designed by state partners such as the Rutgers Climate Change Resource Center and the Rutgers Flood Resilience Lab to provide state agencies and decision makers with pertinent data and modeling to address the planning and emergency response needs with regards to flooding and critical infrastructure.

Extreme Heat Impacts

The average heat wave season in the United States has lengthened by approximately 30 days annually between the 1980s and 2021 and is expected to expand further under continued warming.[31] [32] In New Jersey, extreme high temperature days have generally become more frequent.[33] Daily highs greater than or equal to 90°F have increased at a rate of 2.58 days per decade (from 1967-2022), and lows greater than or equal to 70°F have increased at a rate of 2.64 days per decade.[34]

Extreme heat can put additional strain on infrastructure. Roads, bridges, and other structures made with concrete can buckle due to thermal expansion. Trains face similar issues and suffer from delays and reduced service times to prevent track damage. More people and buildings run air conditioning units, causing increased electricity demand and pressure on the power grid. People are at a higher risk of experiencing heat-related illnesses and there are increases on healthcare facilities, such as hospitals.[35] There will be more frequent and longer periods of high temperatures in the face of climate change.

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[31] Marvel, K., W. Su, R. Delgado, S. Aarons, A. Chatterjee, M.E. Garcia, Z. Hausfather, K. Hayhoe, D.A. Hence, E.B. Jewett, A. Robel, D. Singh, A. Tripati, and R.S. Vose, 2023: Ch. 2. Climate trends. In: Fifth National Climate Assessment. Crimmins, A.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. U.S. Global Change Research Program, Washington, DC, USA. https://doi.org/10.7930/NCA5.2023.CH2. Available at https://nca5.climate.us/downloads/NCA5_Ch2_Climate-Trends.pdf

[32] Habeeb, D., Vargo, J., Stone., Brian Jr. January 2015. Rising heat wave trends in large US cities. *Natural Hazards* (2015) 76:1651-1665. DOI: 10.1007/s11069-014-1563-z.

[33] Cornish, A., Alguera, A., Shope, J. B., Broccoli, A. J., & Yates, J. (2026). Diverse Indicators of Climate Change for New Jersey and Vicinity. *Journal of Applied Meteorology and Climatology*, *65*(4), 471-497. https://doi.org/10.1175/JAMC-D-24-0188.1

[34] Cornish, A., Alguera, A., Shope, J. B., Broccoli, A. J., & Yates, J. (2026). Diverse Indicators of Climate Change for New Jersey and Vicinity. *Journal of Applied Meteorology and Climatology*, *65*(4), 471-497. https://doi.org/10.1175/JAMC-D-24-0188.1

[35] Sweeney, M., Shope, J., Broccoli, A., Gerbush, M., Kaplan, M., Robinson, D., Herb, J. & Cornish, A. 2026. State of the Climate: New Jersey 2025. Rutgers, The State University of New Jersey, New Brunswick, NJ. DOI: 10.7282/00000624.

Wildfire Impacts

Wildfires are unplanned fires in natural areas including forests or grasslands. The NJCCRC's State of the Climate: New Jersey 2024[36] reports that 798 wildfires burned 4,847 acres in New Jersey during the exceptionally dry 2024 fall season. Increasing temperatures are anticipated to cause greater evaporation and drier vegetation, exacerbating conditions contributing to wildfires. Beyond causing immediate damage to communities and infrastructure as well as severe economic impacts, wildfires also generate smoke filled with air pollutants that decrease air quality and pose serious risks to human health.

To assess wildfire risk to New Jersey critical infrastructure, the analyses below utilize the New Jersey Forest Fire Service's Wildfire Hazard Structure Exposure Score (SES).[37] Structure Exposure Score combines wildfire likelihood (burn probability) and consequence (represented by Damage Potential) assuming a home is present on every pixel. SES is analogous to the Risk to Potential Structures dataset but includes ember load. Each SES class (1-10) is 1.5 times higher exposure to wildfire than the previous class. For the analyses below, risk will be assessed against the statewide areas with a score of 'Very High (7)' or above.

Critical Infrastructure and Wildfire Risk

Critical infrastructure facility data is made available through the U.S. Office of Homeland Security's Homeland Infrastructure Foundation-Level Data (HIFLD). This dataset is often referred to as 'lifeline sectors' and provides facility data across multiple types such as communications, energy, financial, food/water/shelter, hazardous materials, health, safety and security, and transportation. A selection of statewide critical facility types are presented below with the number within the 'Very High (7)' and 'Extreme Exposure (8-10)' Wildfire Hazard Structure Exposure Score areas.

[36] Sweeney, M., Shope, J., Broccoli, A., Gerbush, M., Kaplan, M., Robinson, D., Herb, J. & Cornish, A. 2026. State of the Climate: New Jersey 2025. Rutgers, The State University of New Jersey, New Brunswick, NJ. DOI: 10.7282/00000624.

[37] Pyrologix. (2022). *Contemporary wildfire hazard across New Jersey: New Jersey Wildfire Hazard Assessment Project (NJHAZ)*. New Jersey Forest Fire Service; Timmons Group. pyrologix.com. Data available at NJ Forest Fire Service, Wildfire Risk Assessment Portal (NJWRAP) - https://wrap.newjerseywildfirerisk.com

Table 6 - Selected Statewide Critical Infrastructure at Risk to Wildfire			
Facility Type	Total Statewide	Very High Wildfire Exposure	Extreme Wildfire Exposure
Energy Facilities			
Electric Substations	487	4	0
Communications Facilities			
Microwave Service Towers	5,171	78	28
Private Transmission Towers	11,576	127	74
Commercial Transmission Towers	803	19	6
Food/Water/Shelter Facilities			
National Shelter System Facilities	2,151	13	3
Hazardous Materials Facilities			
Toxic Release Inventory Facilities	1,811	4	0
Environmental Response, Compensation, and Liability Information System (Superfund)	1,684	14	3
Health Facilities			
Nursing Homes	610	2	0
Emergency Medical Services	1,267	3	3
Safety and Security Facilities			
Public Schools	2,616	6	1
Private Schools	775	1	0
Local Law Enforcement	624	2	0

Land Parcels and Wildfire Risk

Understanding the wildfire risk to land parcels can help identify potential impacts to housing, commercial businesses, industrial facilities, and public properties that can disrupt both community and economic activity. The table below highlights the wildfire hazard risk to parcels within the 'Very High (7)' and 'Extreme Exposure (8-10)' Wildfire Hazard Structure Exposure Score areas by property class using data from the 2024 tax year.

Table 7 - Land Parcels at Risk to Wildfire Hazard			
Property Class	Total Parcels Statewide	Very High Wildfire Exposure	Extreme Wildfire Exposure
Vacant Land (1)	153,805	7,943	5,340
Residential (2)	2,531,316	10,586	2,852
Farm (3A & 3B)	32,874	1,611	143
Commercial (4A)	118,795	546	182
Industrial (4B)	16,268	112	62
Apartments (4C)	16,905	14	3
Public/Non-Profit School (15A & 15B)	6,940	71	37
Public Municipal (15C)	119,690	7,609	7,034
Church/Charitable/ Cemeteries (15D & 15E)	17,982	142	45
Other Public (15F)	42,768	742	526

The economic impact of wildfires can be extensive and widespread. The table below highlights the value of property improvements (structures) on parcels within the 'Very High (7)' and 'Extreme Exposure (8-10)' Wildfire Hazard Structure Exposure Score areas by property class for the 2024 tax year.

Table 8 - Value of Improvements on Land Parcels at Risk to Wildfire Hazard			
Property Class	Total Parcels Statewide ($M)	Very High Wildfire Exposure ($M)	Extreme Wildfire Exposure ($M)
Residential (2)	$841,757	$3,192	$936.4
Farm (3A)	$1,830	$132.1	$46.6
Commercial (4A)	$146,253	$799.8	$181.5
Industrial (4B)	$58,454	$516.0	$163.7
Apartments (4C)	$57,955	$372.7	$5.7
Public/Non-Profit School (15A & 15B)	$56,336	$965.7	$466.9
Public Municipal (15C)	$41,086	$1,731	$3,699
Church/Charitable/ Cemeteries (15D & 15E)	$24,188	$132.3	$69.8
Other Public (15F)	$32,822	$176.4	$72.7

Roadways and Bridges and Wildfire Risk

Wildfires impact on roadways and bridges can impede travel to work, the distribution of goods, public access to essential services, and emergency response operations. Knowing

what roadways are within high wildfire risk areas is essential for emergency planning. The table below highlights the miles of roadway and number of bridges within the 'Very High (7)' and 'Extreme Exposure (8-10)' Wildfire Hazard Structure Exposure Score areas.

Table 9 - Roadways and Bridges Potentially at Risk to Wildfire Hazard			
	Total Statewide	Very High Wildfire Exposure	Extreme Wildfire Exposure
Roadways (Miles)	49,064	707	407
Bridges (Number)	3,197	38	8

Impacts of Wildfire Risk

The analyses above provide insight into the critical infrastructure that may be at risk to wildfire damage. A large number of properties and a significant value statewide are at 'Very High Exposure' or greater of potential wildfire hazard, posing a threat to community and economic resilience in some areas. While a smaller number of critical facilities are at risk to wildfire exposure when compared to other climate hazards such as flooding, facilities such as those that contain or manage hazards materials are of specific concern due to the possibility of toxic chemicals being released into the atmosphere and threatening nearby communities.

4. Infrastructure: Needs, Most At Risk, Investment, & Resilience Investment Benefits

Infrastructure Needs

Infrastructure in New Jersey is aging or already considered beyond its current lifespan.[38] As the most densely populated state in the country, there is significant wear and tear on infrastructure, and additional strain continues as our population grows.[39] Even before we consider the existing and future impacts of climate change, our infrastructure requires significant maintenance and upkeep to maintain proper service and function. Unmaintained infrastructure is more vulnerable to climate hazard impacts and will cost even more to repair in the aftermath.

Transportation, energy, water supply, and wastewater disposal have been identified in the 2025 State Plan Infrastructure Needs Assessment as the infrastructure sectors with the

[38] American Society of Civil Engineers. 2025. 2025 Infrastructure Report Card. https://infrastructurereportcard.org/state-item/new-jersey/

[39] Canadian Climate Institute. 2026. Prepare or Repair: How Climate-proofing public infrastructure pays off. Available at https://climateinstitute.ca/wp-content/uploads/2026/02/Prepare-or-Repair-climate-proofing-public-infrastructure-Canadian-Climate-Institute.pdf

highest infrastructure funding needs for the next five to fifteen years.[40] The transportation sector has an estimated investment need of $65.7 billion through 2030; the energy sector needs range from $91 billion - $194 billion over the next decade; and water supply and wastewater treatment need over $12 billion and $11.75 billion, respectively, over the next twenty years.[41] These projected investment values do not even consider climate change impacts, which would significantly increase overall investment needs.

The impacts of climate change have increased deterioration and continue to put stress on our infrastructure.[42] [43] Extreme fluctuations of temperatures, increased periods of flooding and standing water, higher usage of certain infrastructure by people during hazardous events (e.g., increased energy demand during heat waves) all shorten the life span of infrastructure and lead to more frequent repairs and replacement.[44]

The infrastructure maintenance and repair needs identified today may change in the coming decades or even by the end of the century due to changing technology that may make infrastructure obsolete and shifting public and private priorities. The way we define critical infrastructural assets and systems can change, therefore altering existing investment needs estimates. Climate change impacts can also evolve over the coming decades for example, sea level rise projections are estimates based on human (e.g., emissions) and environmental factors (e.g., ice sheet stability) that scientists model using scenarios to account for the potential variability in these factors.

Therefore, it is key to integrate adaptive management principles into any infrastructure plans for maintenance, repair, mitigation, and future investments. Adaptive management is an iterative process for adjusting management measures to changing circumstances or new information. It involves exploring alternative ways to meet objectives and then

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[40] Rutgers University. 2025. Final Infrastructure Needs Assessment: 2024-2030. New Jersey State Development and Redevelopment Plan. Prepared for the New Jersey State Planning Commission and the New Jersey Office of Planning Advocacy. https://www.nj.gov/state/bac/planning/documents/update-to-state-plan/njsdrp_ina_dec_2025_final.pdf

[41] Rutgers University. 2025. Final Infrastructure Needs Assessment: 2024-2030. New Jersey State Development and Redevelopment Plan. Prepared for the New Jersey State Planning Commission and the New Jersey Office of Planning Advocacy. https://www.nj.gov/state/bac/planning/documents/update-to-state-plan/njsdrp_ina_dec_2025_final.pdf

[42] New Jersey Department of Environmental Protection. 2025. Economic Risks of Climate Change in New Jersey. https://dep.nj.gov/wp-content/uploads/climatechange/economic-risks-of-climate-change.pdf

[43] Canadian Climate Institute. 2026. Prepare or Repair: How Climate-proofing public infrastructure pays off. https://climateinstitute.ca/wp-content/uploads/2026/02/Prepare-or-Repair-climate-proofing-public-infrastructure-Canadian-Climate-Institute.pdf

[44] The Pew Charitable Trusts. September 2024. Climate Change Poses Risks to Neglected Public Transportation and Water Systems. https://www.pew.org/en/research-and-analysis/issue-briefs/2024/09/climate-change-poses-risks-to-neglected-public-transportation-and-water-systems

implementing one or more of these alternatives if adjustments are needed during a project life cycle to meet or improve expected outcomes and benefits.[45] [46] Adaptive management provides flexibility and can reduce unexpected costs or complete project failure because adjustments were already factored into the planning and implementation process.

Identifying Infrastructure Most At Risk From Climate Hazards

To help identify infrastructure most at risk from climate related hazards, we first reviewed the Infrastructure Needs Assessment from the 2024 New Jersey State Development and Redevelopment Plan to determine infrastructure sector classifications and identification of economic needs, followed by Resilient NJ planning documents, the 2024 State Hazard Mitigation Plan, a sample of county level hazard mitigation plans, and Climate Change Related Hazard Vulnerability Assessments. Within the Resilient NJ documents and state and county hazard mitigation plans, we reviewed the mitigation/resilience action sections to best identify existing targets for infrastructure-related mitigation. In the CCRHVAs and hazard mitigation plans, we looked for hazard identification and impacts on infrastructure. This content analysis comparison across plans allowed us to determine what infrastructure sectors were most prevalently represented by mitigation project types, and impacts identified across the plans, as an indicator for the infrastructure sectors considered most at risk.

We chose this approach in reviewing a set of fifteen total planning documents because they were drafted by expert consultants and have been through a wide public engagement process. Additionally, they offer a broad representation of statewide infrastructure impacts by covering municipalities across the state (inland and coastal) and they either cover statewide needs or offer a regional or municipal perspective. The mitigation and resilience actions identified in the plans were categorized within the eight infrastructure sectors in Table 1 and totaled to help determine which sectors require greater investment needs than others. We acknowledge that a limitation of our document review process is that it does not cover all county level hazard mitigation plans, CCRHVAs, and additional infrastructure and resilience planning documents for every municipality within the state; however, given the scope and time constraints we offer this assessment as a

[45] The U.S. Department of the Interior, Adaptive Management Working Group. 2009. Adaptive Management: The U.S. Department of the Interior Technical Guide. https://www.doi.gov/sites/default/files/uploads/TechGuide-WebOptimized-2.pdf

[46] Fischenich, Craig J., Miller, Sarah J., LoSchiavo J. Andrew. U.S. Army Corp of Engineers, Engineer Research and Development Center. November 2019. A Systems Approach to Ecosystem Adaptive Management. https://erdc-library.erdc.dren.mil/server/api/core/bitstreams/cd6fff5b-b179-4921-a305-362da459c912/content

representative sample of infrastructure impacts and mitigation actions identified for New Jersey.

It is important to note that all eight of the infrastructure sectors we identified in Table 1, currently are and will continue to be impacted by climate change, in addition to natural stress from age and continuous use. Based upon the crosswalk we performed, there are three sectors that particularly stand out: Transportation; Water Resources and Flood Management; and Community, Education, and Cultural Infrastructure.

Transportation

The Transportation sector includes roads, bridges, public transit (for example, NJ Transit and NJ DOT), port facilities, airports, and more. Transportation infrastructure is negatively impacted by climate-related hazards such as flooding (hurricanes, nor'easters, and sea-level rise), increased precipitation, wildfire, and extreme heat. New Jersey maintains about 39,000 miles of public roads that are susceptible to the impacts of climate change. At a national level, it is estimated that the cumulative costs for repairing roads damaged from climate impacts will be between $150 billion to $230 billion by 2100. Annual adaptation costs are estimated to range between $2,000 - $5,000 on a per-lane-mile basis.[47] [48]

Most roads have a lifespan of 20-35 years before requiring significant reconstruction, and the average bridge lifespan falls between 50-75 years.[49] [50] As mentioned previously, infrastructure maintenance and repairs are required independent of climate change impacts. To adjust infrastructure more incrementally to a changing climate and space out spending efforts, mitigation measures that consider common climate hazards should be incorporated into regularly scheduled infrastructure maintenance and repairs.

Water Resources and Flood Management

Water resources and flood management include water supply, water infrastructure, stormwater systems and management, and shoreline protection. This sector is most impacted by flooding (hurricanes, nor'easters, and sea-level rise), extreme heat, and

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[47] New Jersey Department of Environmental Protection. 2025. Economic Risks of Climate Change in New Jersey. https://dep.nj.gov/wp-content/uploads/climatechange/economic-risks-of-climate-change.pdf

[48] United States Environmental Protection Agency. 2017. Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment. U.S. Environmental Protection Agency, EPA 430-R-17-001.

[49] The Pew Charitable Trusts. September 2024. Climate Change Poses Risks to Neglected Public Transportation and Water Systems. https://www.pew.org/en/research-and-analysis/issue-briefs/2024/09/climate-change-poses-risks-to-neglected-public-transportation-and-water-systems

[50] American Society of Civil Engineers. 2025. 2025 Report Card for America's Infrastructure: Bridges. https://infrastructurereportcard.org/cat-item/bridges-infrastructure/

drought. Flooding can lead to contamination of water systems from runoff and saltwater intrusion, and physically damage treatment facilities and systems with standing flood waters. Extreme heat can lead to greater evaporation of water, exacerbating drought conditions. Drought can decrease groundwater and freshwater supplies, leaving less drinking and potable water available to populations.[51]

In urban areas of the state where combined sewer systems are still in use (a system that collects rainwater runoff, domestic sewage, and industrial wastewater into one pipe), combined sewer overflows (CSOs) are a great public health and environmental concern. Increased precipitation and flooding can trigger more CSOs, with increased pollution and contaminants running off into nearby waterbodies and heavily populated areas.[52] [53] "New Jersey municipalities will need to invest more than $19.1 billion over the next 20 years to meet Clean Water Act mandates that protect water resources from pollution, including $8.5 billion for wastewater treatment and $5.9 billion for stormwater infrastructure upgrades alone."[54]

Community, Education, and Cultural Infrastructure

Community, education, and cultural assets include arts, historical and cultural community assets, recreation/parks, and open space. Open space and environmental preservation, restoration, and remediation all fall within this sector. All climate hazards impact this sector, as there are community-based assets and open spaces located throughout the state; inland and coastal, and urban and rural areas. A more detailed analysis of projected climate impacts on these assets can be found within NJ Haz Adapt; an online webtool available through NJ ADAPT (previously mentioned in Section 3).

Common mitigation measures, particularly involving open space and natural environments, include wetland and salt marsh restoration, preservation, and remediation. Wetlands help to mitigate inland flooding by capturing and gradually releasing water. Their ability to store water and slowly release it helps to reduce flood heights and minimize erosion. Wetlands avoided $625 million in direct flood damages during Hurricane Sandy

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[51] The Pew Charitable Trusts. September 2024. Climate Change Poses Risks to Neglected Public Transportation and Water Systems. https://www.pew.org/en/research-and-analysis/issue-briefs/2024/09/climate-change-poses-risks-to-neglected-public-transportation-and-water-systems

[52] United States Environmental Protection Agency. 2026. Combined Sewer Overflows (CSOs). https://www.epa.gov/npdes/combined-sewer-overflows-csos

[53] New Jersey Department of Environmental Protection. 2025. Economic Risks of Climate Change in New Jersey. Trenton, NJ. https://dep.nj.gov/wp-content/uploads/climatechange/economic-risks-of-climate-change.pdf

[54] United States Environmental Protection Agency. (2024). 2022 Clean Watersheds Needs Survey: Report to Congress. In United States Environmental Protection Agency (EPA 832-R-24-002). https://www.epa.gov/system/files/documents/2024-05/2022-cwns-report-to-congress.pdf

across the 12 coastal states that were affected by the storm, which includes New Jersey.[55] When located in urban areas, wetlands can also play a critical role in offsetting the rate and volume of surface water runoff from impervious surfaces and buildings.[56]

Salt marshes, which are typically found in coastal areas, have been found to mitigate coastal erosion and flooding events by reducing wave energy and impact and also serving as water storage.[57] Using an extensive database of property exposure, a regional study using data from Ocean County, NJ shows that wetlands avoided $625 Million in direct flood damages during Hurricane Sandy and estimates a 16% reduction in annual flood losses by salt marshes with higher reductions at lower elevations.[58]

A Note About the Energy Sector

While the energy sector is clearly important to consider with respect to climate change and resilient infrastructure, it is not included in our findings above; in the majority of the planning documents we reviewed, energy-related infrastructure resilience actions are not as prominent as the other sectors identified. Where there are energy related actions, they do not emphasize improving the energy infrastructure itself as much as include actions related to: partnering with utilities for creating resilience hubs, individuals raising electrical and mechanical equipment for flood protection (which could be categorized in the Water sector), or for private property owners to increase energy resilience during power outages.[59] [60] [61] It may be that the lack of identification of electricity infrastructure mitigation programs in these comprehensive planning approaches could be attributed to the fact that private companies are not beholden to carry out actions identified in these plans. The

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[55] Narayan, S., Beck, M.W., Wilson, P. *et al.* The Value of Coastal Wetlands for Flood Damage Reduction in the Northeastern USA. *Sci Rep* 7, 9463 (2017). https://doi.org/10.1038/s41598-017-09269-z

[56] Spector, A., J. Barr, M. Duca, and W. Irving. 2025. New Jersey Nature-Based Solutions. Rutgers, The State University of New Jersey. New Brunswick, NJ: Rutgers University. https://njclimateresourcecenter.rutgers.edu/wp-content/uploads/2025/07/Nature-Based-Solutions-071525.pdf

[57] Spector, A., J. Barr, M. Duca, and W. Irving. 2025. New Jersey Nature-Based Solutions. Rutgers, The State University of New Jersey. New Brunswick, NJ: Rutgers University. https://njclimateresourcecenter.rutgers.edu/wp-content/uploads/2025/07/Nature-Based-Solutions-071525.pdf

[58] Narayan, S., Beck, M.W., Wilson, P. *et al.* The Value of Coastal Wetlands for Flood Damage Reduction in the Northeastern USA. *Sci Rep* 7, 9463 (2017). https://doi.org/10.1038/s41598-017-09269-z

[59] New Jersey Department of Environmental Protection. 2022. Resilient NJ Northeastern New Jersey Action Plan. Available at https://dep.nj.gov/wp-content/uploads/ocr/rnj_nenj_action-plan.pdf

[60] New Jersey Department of Environmental Protection. 2022. Resilient NJ Protect, Restore, Transition. A Resilience Action Plan for the Raritan River and Bay Communities Region. Available at https://dep.nj.gov/wp-content/uploads/ocr/resilientnj/docs/rrbc-action-plan.pdf

[61] New Jersey Department of Environmental Protection. 2022. Resilient NJ Atlantic County Coastal Region Regional Resilience and Adaptation Action Plan (RRAAP). Available at https://dep.nj.gov/wp-content/uploads/ocr/resilientnj/docs/rnj_final-action-plan-report.pdf

majority of New Jersey electricity customers are served by four private electric distribution companies (EDCs).[62] Further, these EDCs are required to meet Minimum Reliability Levels (MRLs) established by the New Jersey Board of Public Utilities (BPU) related to system interruption frequency and customer interruption duration, have programs and procedures in place to maintain MRLs to sustain and improve reliability, must submit to BPU Annual System Performance Reports regarding electric service reliability, further examine equipment and circuits for causes of systemic outages and implement and report corrective measures, and have inspection and maintenance programs in place to provide safe, proper and adequate service.[63] [64] [65] [66] BPU can authorize these utilities to recover the cost of their capital investment for infrastructure resilience through their rate base under the Infrastructure Investment Program for Utilities.[67] These have included for example, electrical grid upgrades to overhead circuits, vegetation management, flood mitigation enhancements in substations, raising and rebuilding substations, replacing exposed overhead power lines with insulated aerial cables, voltage optimization to name a few mitigation measures.[68] [69] Utility companies are required to submit post-event reports to BPU within 20 days of major events that affect 10% of customers within a 48-hour period and such events can include thunderstorms, tornadoes, hurricanes, heat waves, and snow and ice storms.[70] [71] These post-event reports provide a snapshot of performance to a specific event that can help BPU design corrective actions for utilities. For example, these reports, along with other documentation from EDCs were reviewed by BPU staff who identified areas for improvement after Tropical Storm Isaias in 2020, including state-wide deployment of Advanced Metering Infrastructure.[72]

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[62] Infrastructure Needs Assessment 2024- 2030, New Jersey State Development and Redevelopment Plan. https://www.nj.gov/state/bac/planning/documents/update-to-state-plan/njsdrp_ina_dec_2025_final.pdf

[63] N.J.A.C. 14:5-8.10(a)

[64] N.J.A.C. 14:5-8.8

[65] N.J.A.C. 14:5-8.5(c) and (d)

[66] N.J.A.C. 14.5-8.6 (a)

[67] N.J.A.C. 14:3-2A.1 et seq.

[68] In re the Verified Petition of Jersey Central Power & Light Company for Approval of an Infrastructure Investment Program (JCP&L Reliability Plus), BPU Docket No. EO18070728, Order dated May 8, 2019 ("Reliability Plus Order"). Available at https://www.nj.gov/bpu/pdf/boardorders/2019/20190508/5-8-19-2B.pdf

[69] In re the Petition of Public Service Electric and Gas Company for Approval of an Infrastructure Advancement Program (IAP), BPU Docket Nos. EO21111211 and GO21111212, Order dated June 29, 2022 ("IAP Order") Available at https://publicaccess.bpu.state.nj.us/CaseSummary.aspx?case_id=2110840

[70] N.J.A.C. 14:5-8.9

[71] N.J.A.C. 14:5-1.2

[72] Giuliano, J. 2020. Review and Assessment of Electric Utility Performance. August 4, 2020 Tropical Storm Isaias Weather Event. State of New Jersey Board of Public Utilities. https://www.nj.gov/bpu/pdf/boardorders/2020/20201118/6A%20-%202020%20Tropical%20Storm%20Isaias%20BPU%20Staff%20Report.pdf

The BPU can require these utilities to make investments in specific types of infrastructure or projects to address reliability and resilience concerns. BPU can also impose penalties for poor performance including reduced or in some cases no recovery for ineffective investments up to and including financial penalties that may not be recovered from customers.[73]

Climate-Resilient Infrastructure Investment

Climate-resilient infrastructure should be considered a public good, because it is infrastructure that has been made more resilient by for example, preventing flooding through implementing stormwater management measures, and these benefits accrue to households, businesses, public services, schools, and transportation services that suffer severe disruption during storm events. This sort of public good cannot be easily restricted to paying users and therefore private markets systematically underprovide resilience.[74] Further, Vayida and Brown (2026) note that from a macroeconomic perspective, climate-resilient infrastructure also functions as a systemic risk reducer, finding that by lessening the likelihood and intensity of service disruptions during climate-related events, resilience investments lower output instability, protect tax bases, and limit contingent fiscal liabilities.

Considering infrastructure investment and vulnerability to disaster, interventions can be evaluated through three economic lenses as suggested by Vayida and Brown (2026): system criticality where infrastructure assets are hubs within economic and social networks (e.g., transportation corridors critical for food supply) which can trigger widespread ripple effects when they fail; distributional impacts on socially vulnerable populations; and financial risk that that will result in increased reconstruction spending and debt. The high costs of infrastructure disruptions and damages could be reduced by using criticality analyses to prioritize interventions focusing on the capacity (i.e., quantity) that infrastructure services assets provide.[75] Hallegatte et al. (2019) propose thinking of infrastructure systems as a systemic network of nodes and connecting links to facilitate the flow of people, goods, materials, energy, and services between origin and destination pairs working at the network and systems levels, allowing for evaluation of redundancy to cope with disruption and to identify opportunities for intervention with high returns across transportation, energy, telecommunications, and water systems.

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[73] N.J.A.C. 14:5-8 et. seq.

[74] Vaidya, M. and S. Bhowmick. 2026. Climate-resilient infrastructure as a public good: welfare, risk, and climate-smart growth. Challenges. 17(2), 13. https://doi.org/10.3390/challe17020013

[75] Hallegatte, S., J. Rentschler, and J. Rozenberg. 2019. Lifelines. The Resilient Infrastructure Opportunity. Sustainable Infrastructure. Washington, EDC: World Bank. Available at https://openknowledge.worldbank.org/handle/10986/31805

Other considerations in prioritizing infrastructure investment can include diversifying assets to increase network resilience (e.g., varied power generation sources, multimodal transportation, urban planning) and decentralizing and using new technologies (e.g., distributed power via solar and energy storage or microgrids) and working across systems to capture synergies and understand complex interdependencies and potential domino effects between infrastructure and sectors. Mutual reliance includes for example: all sectors being dependent on electricity; the power sector relying on passable road networks for transmission repair; or roads concentrating runoff and impacting water movement, hydrology, and flooding.[76] Hallegate et al. (2019) also note that combining green and grey infrastructure can provide lower-cost, more resilient, and more sustainable infrastructure solutions. Additionally, Hallegatte et al. (2019) cite the principle of minimizing risk by investments in infrastructure that will direct residences and businesses to low-risk areas as well as avoiding investments in areas that are highly exposed to coastal flooding and sea level rise. Therefore, a set of guiding principles that capture these tenets may be helpful in evaluating and prioritizing projects.

The *Economic Risks of Climate Change in New Jersey* is an instructive synthesis noting that coastal and inland infrastructure face increasing exposure to flooding, extreme heat, wildfires, and sea-level rise, impacting transportation, energy, and water infrastructure systems.[77] Forward-thinking investments in resilience infrastructure, including structural and nature-based interventions, can significantly reduce long-term repair and recovery costs. The authors note that climate change poses significant and interconnected risks to New Jersey's economy, infrastructure, and communities, requiring proactive investments in resilience and adaptation measures to prevent future damages and ensure stability and growth. The report finds the most pressing statewide economic threats driven by climate change to be: 1) residential and commercial property and insurance market impacts (including declining properties values in high-risk areas, increased mortgage default risk, rising insurance market costs for residential and commercial property owners, and rising housing costs) and 2) accelerating infrastructure vulnerabilities defined as deteriorating transportation assets (roads, bridges, rail lines), essential public health and safety infrastructure (electrical grids and stormwater, wastewater, and drinking water treatment facilities particularly in low-lying coastal communities), and gray (e.g., flood walls, levees,

[76] Hallegatte, S., J. Rentschler, and J. Rozenberg. 2019. Lifelines. The Resilient Infrastructure Opportunity. Sustainable Infrastructure. Washington, EDC: World Bank. Available at https://openknowledge.worldbank.org/handle/10986/31805

[77] New Jersey Department of Environmental Protection. 2025. Economic Risks of Climate Change in New Jersey. Trenton, NJ. Available at https://dep.nj.gov/wp-content/uploads/climatechange/economic-risks-of-climate-change.pdf

tide gates, pump stations) and green infrastructure (coastal dunes, living shorelines, bioretention systems) for flood protection.

Benefits of Investing in Resilience

There is a growing literature on the benefits of investing in resilience, with some studies addressing specific infrastructure types as noted below.

Heubam et al. (2022) cite a "triple dividend of resilience" actions that considers avoided losses (first dividend), induced economic or development benefits (second dividend), and additional social and environmental benefits (third dividend), noting the latter two accrue regardless of whether the actual climate risk materializes, can exceed the value of avoided losses, and can generate project benefit-cost ratios greater than 1 even absent the value of avoided losses.[78] Brandon et al. (2025) evaluated the full benefits of 320 adaptation investments in agriculture, infrastructure, and health made between 2014 and 2024 by multi-development banks and international climate finance institutions across twelve socially and economically diverse countries in Asia, Africa, and Latin America considered on average moderately vulnerable to climate change and representing 48% of the global population. Using the triple dividend approach, they found the average return on investment to be 27%, that for infrastructure-related adaptation projects (including in energy, transport, and cities) benefits are generated across all three dividends, and that half of all the evaluated adaptation investments also yield emissions reduction co-benefits.[79]

The commercial property insurer, FM Global reported on its own internal research of 10,000 wind and flood related investments for 1,800 clients around the world, finding that for every $1 a business spends on hurricane protection, they realize an associated $105 reduction in property loss and business disruption average associated property loss.[80]

The National Institute of Building Sciences Multi-Hazard Mitigation Council assessed various mitigation strategies for riverine surge, hurricane surge, hurricane wind, earthquake, and wildland-urban interface fire hazards.[81] Benefits from these various

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[78] Heubaum, H., C. Brandon, T. Tanner, S. Surminski, and V. Roezer. 2022. "The Triple Dividend of Building Climate Resilience: Taking Stock, Moving Forward." Working Paper. Washington, DC: World Resources Institute. Available at https://doi.org/10.46830/ wriwp.21.00154.

[79] Brandon, C., B. Kratzer, A. Aggarwal, and H. Heubaum. 2025. "Strengthening the investment case for climate adaptation: A triple dividend approach." Working Paper. Washington, DC: World Resources Institute. Available at doi.org/10.46830/wriwp.25.00019.

[80] FM Global. 2018. Take that to the bank. Reason Magazine. Issue 2. p. 27; Middlemiss, N. 2018. Study reveals impressive ROI for hurricane protection. Insurance Business.

[81] National Institute of Building Sciences (NIBS). (2019.). Natural Hazard Mitigation Saves: 2019 Report. Principal Investigator Porter, K.; Co-Principal Investigators Dash, N., Huyck, C., Santos, J., Scawthorn, C.; Investigators: Eguchi, M., Eguchi, R., Ghosh., S., Isteita, M., Mickey, K., Rashed, T., Reeder, A.; Schneider, P.;

strategies included reductions in: deaths, nonfatal injuries, post-traumatic stress disorder, property repair costs, business interruption, loss of community services (e.g., police, fire, hospital and public buildings damage), search and rescue, and environmental losses. This same report found that every $1 invested in resilience measures can save up to $13, with a national average ranging from $4 to $11 in avoided future losses. In an often-quoted statistic about investment in climate resilience, $6 in savings per $1 investment was identified in their analysis of 23 years of public-sector federal investment in select federal agency mitigation grant programs (e.g., Economic Development Administration, Federal Emergency Management Agency, Housing and Urban Development). In evaluating benefits and costs of mitigation to utilities and the transportation sector in the United States, the authors find a benefit-cost ratio of $4 savings to every $1 spent (these included projects to elevate roads and railroads, water and wastewater flood protection, electricity flood protection and undergrounding electric transmission lines). An evaluation of adopting building codes yielded an 11 to 1 benefit cost ratio.[82]

In its 2024 report, *The Preparedness Payoff: The Economic Benefits of Investing in Climate Resilience*, the U.S. Chamber of Commerce, working in partnership with Allstate and the U.S. Chamber of Commerce Foundation, concluded that in addition to what they cite as the accepted ratio of $1 invested in resilience and preparedness reduces damage and cleanup costs of a disaster by $6 from the aforementioned NIBS 2019 study, the authors note each $1 of investment also reduces a community's local economic costs (including jobs, workforce participation, production, and earned income for residents) after an event by an additional $7 and that combining the two results in savings of $13 in economic impact, damage and clean-up costs after an event.[83] While investment in resilience and preparedness will not prevent losses, the authors note it can significantly reduce them, including economic benefits for a community with respect to continued economic growth and income and that these investments have large potential benefits from large cities to small communities alike. Further, they concluded that if a disaster does not hit, communities still enjoy economic gains from investments in preparedness. Community

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and Yuan, J., Directors, MMC. Investigator Intern: Cohen-Porter, A. National Institute of Building Sciences. Washington, DC. www.nibs.org

[82] National Institute of Building Sciences (NIBS). (2019.). Natural Hazard Mitigation Saves: 2019 Report. Principal Investigator Porter, K.; Co-Principal Investigators Dash, N., Huyck, C., Santos, J., Scawthorn, C.; Investigators: Eguchi, M., Eguchi, R., Ghosh., S., Isteita, M., Mickey, K., Rashed, T., Reeder, A.; Schneider, P.; and Yuan, J., Directors, MMC. Investigator Intern: Cohen-Porter, A. National Institute of Building Sciences. Washington, DC. www.nibs.org

[83] U.S. Chamber of Commerce. 2024. The Preparedness Payoff: The Economic Benefits of Investing in Climate Resilience. Available at https://www.uschamber.com/security/the-preparedness-payoff-the-economic-benefits-of-investing-in-climate-resilience

based infrastructure investment actions identified here included mitigation planning such as adopting zoning, land-use practices, and building codes to prevent/reduce damage.[84]

The National Institute of Building Sciences Consultative Council in its *2025 Moving Forward Report*, noted that the benefits of resilience extend far beyond the individual property owner and called for shared responsibility among various stakeholders including insurance companies, mortgage industry, businesses and government agencies who all gain from mitigated damage and faster recovery and share in the expense of retrofitting buildings. Among the recommendations include tax incentives (e.g., income or property tax credits and sales tax exemptions to offset retrofit costs) as well as establishing grant programs to provide direct funds to communities and households at the highest risk of damage from natural hazards, which would save government agencies money in the long run.[85]

A 2026 national assessment of how climate change will affect the costs of maintaining, renewing, and repairing public infrastructure across Canada, compares a scenario where infrastructure is maintained for the past climate and adaptation is either reactive or non-existent, to a scenario where proactive, sustained investments help prepare infrastructure for a harsher and more volatile future climate. The results show that acting early lowers long-term costs, improves infrastructure reliability, and reduces economic disruption.[86] [87]

Tools developed for assessing the return on infrastructure investment may be instructive for applications to New Jersey and could be considered in guiding practices for resource allocation. For example, the U.S. Department of Transportation (DOT) Volpe National Transportation Systems Center developed the open source Resilience Disaster Recovery Tool to explore which resilient road and transit infrastructure investments provide the

[84] U.S. Chamber of Commerce. 2024. The Preparedness Payoff: The Economic Benefits of Investing in Climate Resilience. Available at https://www.uschamber.com/security/the-preparedness-payoff-the-economic-benefits-of-investing-in-climate-resilience

[85] National Institute of Building Sciences (NIBS) Consultative Council. 2025. Moving Forward Report. Available at https://nibs.org/2025-moving-forward-repor

[86] Canadian Climate Institute. 2026. Prepare or Repair: How Climate-proofing public infrastructure pays off. Available at https://climateinstitute.ca/wp-content/uploads/2026/02/Prepare-or-Repair-climate-proofing-public-infrastructure-Canadian-Climate-Institute.pdf

[87] WSP Canada. 2026. Climate Change Cost-Benefit Analysis for Public Infrastructure in Canada: Technical Report. Montréal, QC: WSP Canada Inc. https://climateinstitute.ca/wp-content/uploads/2026/03/Technical-Report_Climate-Change-Cost-Benefit-Analysis-Public-Infrastructure-Canada.pdf

greatest return under a range of uncertain future hazard conditions and how benefits of investments are distributed across users of transportation networks.[88]

The Port Authority of New York and New Jersey (PANYNJ) has developed its Climate Risk Assessment (CRA) program to identify and mitigate current and future climate-related risks (coastal flooding with sea level rise; stormwater flooding with sea level rise, and extreme heat) to its critical assets, noting that such assessments have been performed for each of the PANYNJ major facilities across its Air, Land, Rail, and Sea Departments. The CRA is designed to address: operational and financial consequences if an asset fails; site-specific climate risk; conceptual engineering approaches to reduce the risk of critical asset failures and their benefit-cost; and what are the most cost-effective risk mitigation measures for consideration in the PANYNJ capital planning process.[89]

5. Programs that Address Climate Impacts to New Jersey Infrastructure

There are existing programs within New Jersey that identify and address infrastructure sector needs with a climate resilience nexus. We highlight a set of key programs below, but this is not an exhaustive list of all programs that exist within the state.

Community-Based Climate Change Resilience Programs

Resilient NJ (RNJ) is an NJDEP Office of Climate Resilience program that supports collaborative community-based planning efforts to create and implement resilience planning solutions to address current and future climate related hazards. Regional planning projects include teams of municipalities, counties, and community-based organizations paired with qualified consultants to create Regional Resilient Action Plans. The resilience action plans are intended to increase resilience, build local capacity, and allow local governments to address their needs while enhancing the value and integrity of ecological, economic, recreational, and natural resources in their communities.[90]

In 2021, the New Jersey Municipal Land Use Law (N.J.S.A. 40:55D-28b.(2)(h)) was amended to require a Climate Change Related Hazard Vulnerability Assessment in the Land Use Element of Municipal Master Plans. CCRHVAs perform an "analysis of current and future threats to, and vulnerabilities of, the municipality associated with climate change-related natural hazards, including, but not limited to increased temperatures, drought, flooding,

[88] U.S. Department of Transportation. n.d. Resilience and Disaster Recovery (RDR) Tool Suite. Volpe National Transportation Systems Center. https://volpeusdot.github.io/RDR-Public/ accessed 4 August 2026.
[89] Port Authority of New York and Jersey. n.d. Climate Risk Assessment. https://www.panynj.gov/port-authority/en/about/Environmental-Initiatives/climate-resilience/climate-risk-assessment.html accessed 4 August 2026.
[90] New Jersey Department of Environmental Protection. 2026. Resilient NJ. Planning Projects. Office of Climate Resilience. https://dep.nj.gov/ocr/resilientnj/projects/ accessed 6 August 2026.

hurricanes, and sea-level rise."[91] As part of the RNJ program, CCRVHAs are developed for participating municipalities. A portion of the award is also used for the implementation of identified resilience actions. Through its Municipal Assistance Program, RNJ supports the development of municipal resilience action plans, CCRHVAs, and implementation of identified municipal resilience actions.[92]

In addition, NJDEP's Building a Climate Ready NJ program is leveraging existing efforts to expand resilience in many of New Jersey's most densely populated communities including: multi-municipal regional resilience planning and project implementation; neighborhood-scale green infrastructure to manage stormwater; marshland restoration and co-designed natural and nature-based resilience projects identified through previous planning efforts in disadvantaged and overburdened communities. This program also includes an educational and training component that will build resiliency capacity in the state through green infrastructure training, hands-on learning experiences for community college students on design and monitoring of green infrastructure projects, training on successful coastal ecological restoration, and for K-12 educators to engage students in local climate resilience.[93] [94]

Hazard mitigation plans (HMPs) are plans that identify hazards, the potential risks and impacts they have on people and infrastructure, and associated actions that can be completed to help mitigate these hazards. The New Jersey Office of Emergency Management oversees the completion of HMPs at the state and county (which includes municipalities) levels and works with FEMA to review and approve these plans. HMPs are updated every five-years by the state and counties, which include chapters on their municipalities. FEMA requires jurisdictions to maintain approved HMPs to be eligible for certain types of non-emergency assistance. This includes mitigation project funding, such as the Building Resilient Infrastructure and Communities (BRIC) and Hazard Mitigation Grant Program (HMGP) programs that offer millions of dollars in awards annually. FEMA has a federal set of guidelines that all jurisdictions must meet to obtain an approved HMP. States can set additional regulatory requirements that can be more stringent. In 2024, P.L.2023, c.13 was enacted in New Jersey, requiring all HMPS within the state to address

[91] NJ Rev Stat § 40:55D-28 (2025)
[92] New Jersey Department of Environmental Protection. 2026. Resilient NJ. Planning Projects Office of Climate Resilience. https://dep.nj.gov/ocr/resilientnj/projects/ accessed 6 August 2026.
[93] New Jersey Department of Environmental Protection. 2026. Building a Climate Ready NJ. Coastal Management Program. https://dep.nj.gov/climateready/ accessed 6 August 2026.
[94] New Jersey Department of Environmental Protection. 2024. DEP Receives $72 Million from NOAA to advance Climate Resilience Projects Across Multiple New Jersey Counties. Available at https://dep.nj.gov/newsrel/24_0030/

climate change and consider future hazard conditions; a requirement that FEMA also had until 2025.

The NJ Community Hazard Assistance Mitigation Program (NJ CHAMP) is a partnership between the NJ Infrastructure Bank (I-Bank) and the NJ Office of Emergency Management to help administer funds to finance hazard mitigation and resilience projects within the state. The program was created originally to apply for the Safeguarding Tomorrow through Ongoing Risk Mitigation (STORM) Act, available through FEMA. The STORM Act of 2020 awarded funds to states to establish a revolving loan fund program for hazard mitigation assistance. NJ CHAMP awards low-cost financing for relevant projects and manages the repayments as revolving loan funds to refinance additional projects.[95] [96]

The NJ Department of Community Affairs (DCA) offers the Resilient Communities Program (RCP). The RCP is a competitive grant program related to Hurricane Ida recovery, with funds from the U.S. Department of Housing and Urban Development, Community Development Block Grant-Disaster Recovery (CDBG-DR). The program is intended to fund counties, municipalities, special districts, and federally recognized tribes to help unmet recovery and mitigation needs for public infrastructure projects that will help HUD-identified and State-identified "most impacted and distressed" areas become more resilient to current and future flood-related natural hazards.[97]

Land Preservation

The New Jersey Garden State Preservation Trust (GSPT) is an independent gatekeeper and distributor of funds related to land preservation within the state. The 1999 New Jersey Garden State Preservation Trust Act financed the acquisition and preservation of open space, farmland, and historic sites.[98] The GSPT uses a mixture of tax appropriations, bonds, and a portion of the Corporation Business Tax (CBT) to fund key programs such as Green Acres, Blue Acres, and Farmland Preservation.

The Green Acres program was created in 1961, for land and open space preservation within New Jersey. The program, within NJDEP, funds acquisitions and local development of parks and recreations facilities. The program consistently works with public and nonprofit partners to acquire and fund open space projects. As of 2024, Green Acres has

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[95] New Jersey Resilience Infrastructure Bank. 2023. NJ CHAMP Program. Available at https://www.njib.gov/news/nj-champ-program

[96] New Jersey Infrastructure Bank and The New Jersey State Police Office of Emergency Management. 2023. Community Hazard Assistance Mitigation Program. State Fiscal Year 2024. Available at: https://cdn.njib.gov/champ/publications/SFY2024/SFY24_CHAMP_May_Report.pdf

[97] New Jersey Department of Community Affairs. Resilient Communities Program. n.d. https://www.nj.gov/dca/ddrm/programs/ida/infrastructure.shtml accessed 11 August 2026.

[98] NJ Rev Stat § 13:8C-4 (2025)

directly protected more than 725,000 acres of open space and parkland and has funded 1,256 local and nonprofit park development and stewardship projects in communities around the state.[99]

Blue Acres is an NJDEP property acquisition program whose purpose is to buy out homes that are flood-prone or flood damaged, and to help preserve vacated land as flood storage buffers against future flooding. Properties acquired through this program are permanently barred from undergoing any development or redevelopment. It is a rolling program that remains open year-round to acquiring properties, independent of storm event occurrences. Buy outs are completely voluntary, and homeowners can indicate interest by completing an online application.[100] Since its inception in 1995, Blue Acres has preserved more than 360 acres and acquired more than 1,200 properties.[101]

The Farmland Preservation program is administered by the State Agriculture Development Committee and is intended to preserve and protect farmland from development. Interested farm owners have multiple options for farm preservation. They can continue farming but sell their development easements; they can donate the development rights for all or a portion of their land; or they can sell their farm outright. Any farms or development easements sold to the program will forever be protected for agricultural use only.[102]

Water

The New Jersey Water Bank (NJWB) is a partnership between NJDEP and the New Jersey Infrastructure Bank (I-Bank), providing low-cost financing for the design, construction, and implementation of projects aimed at protecting and improving water quality, as well as ensuring safe and adequate drinking water for New Jersey residents. It finances projects using revenue bonds issued by the I-Bank and funds administered by the NJDEP, including Federal State Revolving Fund capitalization grants, state matching funds, loan repayments, state appropriations, and interest earned. The NJWB has issued 1,414 loans that have resulted in 1,666 projects.[103] Over the last 9 fiscal years, the NJWB has provided over $5.5 billion in financing to construct clean water and drinking water projects.[104]

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[99] New Jersey Department of Environmental Protection. Green Acres. https://dep.nj.gov/greenacres/
[100] New Jersey Department of Environmental Protection. 2026. Blue Acres: Homeowners. Available at https://dep.nj.gov/blueacres/homeowners/
[101] New Jersey Department of Environmental Protection. 2025. Blue Acres Celebrates 30 Years. https://dep.nj.gov/blueacres/blue-acres-celebrates-30-years/
[102] State of New Jersey Department of Agriculture, State Agriculture Development Committee. 2026. Farmland Preservation: Overview. https://www.nj.gov/agriculture/sadc/farmpreserve/
[103] New Jersey Department of Environmental Protection. The New Jersey Water Bank. https://dep.nj.gov/wiip/njwb-process/about-us/
[104] New Jersey Department of Environmental Protection. 2026. Water Infrastructure Spending Dashboard: Clean and Drinking Water Investments. https://dep.nj.gov/wiip/spending-dashboard/

The 2019 Clean Stormwater and Flood Reduction Act (P.L.2019, c. 42 (C.40A:26B-1 et seq.) allows local governments to establish their own stormwater utilities and collect fees. It also establishes a special non-lapsing "Clean Stormwater and Flood Reduction Fund" that is to be used by the NJ DEP to exclusively fund "planning, implementation, and coordination activities related to stormwater utilities in the State, water quality monitoring and assessment, point and non-point source water pollution reduction projects, implementation of the department's stormwater management program, and a public education and outreach program relating to stormwater management."[105] The Act also explicitly encourages the use of green infrastructure in stormwater management.

Transportation

The North Jersey Transportation Planning Authority (NJTPA), a federally authorized Metropolitan Planning Organization for the 13-county northern New Jersey region, has been integrating climate change resilience planning into its work from more than a decade.[106] [107] In partnership with the Port Authority of NY and NJ, in 2024, it adopted a Resilience Improvement Plan which, among other things, identifies completed and existing resilience improvement planning efforts, includes a risk-based assessment of vulnerabilities to current and future weather events and natural disasters, and a list of prioritized resilience projects.[108]

New Jersey Department of Transportation (NJDOT) has developed an internal Resilience Management System to integrate flooding considerations in State, county, and regional planning initiatives to help guide agency actions.[109] NJDOT notes that it is creating a Resilience Improvement Plan to enhance the resilience of its transportation network against weather events and natural disasters, as well as notes it is developing design strategies to improve highway bridge resilience against multiple hazards.[110]

NJDOT released *A Framework for Managing Sediment in the Back Bays of New Jersey* to facilitate the use of sediment (routinely dredged to keep New Jersey's navigation channels clear for marine traffic) for restoration, enhancement, and protection of tidal habitats that

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[105] P.L.2019, c. 42 (C.40A:26B-1 et seq.)
[106] North Jersey Transportation Planning Authority. 2026. The NJTPA. Available at https://njtpa.org/the-njtpa/
[107] North Jersey Transportation Planning Authority. 2024. NJTPA Resilience Improvement Plan. Available at https://njtpa.org/wp-content/uploads/2025/11/2024-NJTPA-Resilience-Improvement-Plan-RIP.pdf
[108] North Jersey Transportation Planning Authority. 2024. NJTPA Resilience Improvement Plan. Available at https://njtpa.org/wp-content/uploads/2025/11/2024-NJTPA-Resilience-Improvement-Plan-RIP.pdf
[109] New Jersey Interagency Council on Climate Resilience. 2025. Member Agency Profile. NJ Department of Transportation. Available at https://dep.nj.gov/wp-content/uploads/climatechange/njdot_memberprofile-v2.pdf
[110] New Jersey Interagency Council on Climate Resilience. 2025. Member Agency Profile. NJ Department of Transportation. Available at https://dep.nj.gov/wp-content/uploads/climatechange/njdot_memberprofile-v2.pdf

are struggling to keep pace with sea-level rise.[111] [112] The loss of sediment puts at risk both the tidal habitats and the infrastructure and communities they protect.[113] This framework was the result of a multi-year initiative supported by NJDOT in collaboration with key state and federal agencies and partner organizations. It has established a collaborative process to prioritize and plan for managing sediment along New Jersey's coastline and to ensure that coastal sites are agreed upon, prioritized and design-ready to advance through permitting and receive dredged material when available.[114]

Complete & Green Streets for All is a model policy and guide as a resource for New Jersey municipalities, counties, agencies, and organizations with an interest in implementing such a program in their communities, or for those who already have a Complete Streets program. A model resolution for adoption by a government entity (municipality, county, state) is included "to provide a comprehensive, integrated, connected multi-modal network of transportation options through planning, design, construction, maintenance, and operation of new and retrofit transportation facilities along the entire right-of-way for all users of all ages and abilities."[115] Adopting and implementing the policy is a commitment to apply Complete Streets principles to all transportation decisions and investments. The Green Streets component employs green infrastructure practices within the public right-of-way to manage stormwater while preserving the function of a street as a conduit for vehicles, pedestrians, bicyclists, and transit riders. Green infrastructure practices, such as permeable pavement, stormwater planters and tree pits, bioswales,

[111] New Jersey Dept. of Transportation. 2024. A Framework for Managing Sediment in the Back Bays of New Jersey. New Jersey Department of Transportation, Trenton, NJ. Available at: https://www.njcoastalresilience.org/wp-content/uploads/2025/05/Final-RSM-Framework_TNC_NJ_Back-Bays.pdf

[112] New Jersey Department of Transportation. 2025. NJDOT embarks on 'sedimental journey to improve 127 miles of New Jersey coastline. Available at https://dot.nj.gov/transportation/uploads/comm/news/details/comm_np_20250508_134258_NJDOTembarksonasendimentaljourneytopresserve127milesofshoreline.pdf

[113] New Jersey Dept. of Transportation. 2024. A Framework for Managing Sediment in the Back Bays of New Jersey. New Jersey Department of Transportation, Trenton, NJ. Available at: https://www.njcoastalresilience.org/wp-content/uploads/2025/05/Final-RSM-Framework_TNC_NJ_Back-Bays.pdf

[114] New Jersey Department of Transportation. 2025. NJDOT embarks on 'sedimental journey to improve 127 miles of New Jersey coastline. Available at https://dot.nj.gov/transportation/uploads/comm/news/details/comm_np_20250508_134258_NJDOTembarksonasendimentaljourneytopresserve127milesofshoreline.pdf

[115] New Jersey Department of Transportation. 2020. Complete & Green Streets for All. Available at https://njbikeped.org/wp-content/uploads/2022/08/CS_Model_Policy_2020-R.pdf

and rain gardens, enable stormwater and melting snow to soak into soils, preventing runoff and minimizing local flooding.[116] [117]

New Jersey Transit's 2024 Sustainability Plan, identifies resilience strategies, initiatives and investments to address its vulnerability to climate change citing various programs and projects that have been implemented to address hardening and operational practices to prepare, respond, and recover from natural disasters and hazards, and that an all-hazards approach to transportation resilience has become a high priority. NJ Transit notes it will conduct systematic resilience studies of bus, rail, and light rail infrastructure assets, and services to determine short- and long-term exposure to climate change impacts and will prioritize and develop adaptation project to protect vulnerable critical assets, implementing an asset-criticality approach to understand the level of impact that failure of specific assets has on the transit network.[118] The 2025 NJ Transit Annual Report also points to the NJ Transit's 5-Year Capital Plan as including an emphasis on better preparing NJ Transit to withstand and recover from future extreme weather events.[119]

The programs mentioned above all help to identify climate impacts on infrastructure within New Jersey, and associated mitigation and resiliency actions. While they may overlap in some respects (such as hazard identification and potential jurisdictional impact), they are distinct programs that serve different purposes and all contribute to the advancement of infrastructure resilience measures within the state, providing an excellent foundation upon which to build further infrastructure investments.

6. Concluding Analyses and Thoughts for Consideration

Below we provide some concluding analyses and thoughts for consideration related to the need for investment and sustaining a climate resilience framework for New Jersey, including diversification of funding strategies for infrastructure resilience, accounting for

[116] NJDOT Bicycle & Pedestrian Resource Center. n.d. Complete & Green Streets for All: Model Policy & Guide. https://njbikeped.org/complete-green-streets-for-all-model-policy-guide/ accessed 11 August 2026.
[117]New Jersey Department of Transportation. 2020. Complete & Green Streets for All. Available at https://njbikeped.org/wp-content/uploads/2022/08/CS_Model_Policy_2020-R.pdf
[118] New Jersey Transit. 2024. NJ Transit Sustainability Plan. Available at https://content.njtransit.com/sites/default/files/sustainability/NJ_TRANSIT_Sustainability_Plan_FINAL_WEB.pdf
[119] New Jersey Transit. 2025. Annual Report. Shaping the Future. Roadmap to a New Era of Reliability and Customer Experience. Available at https://content.njtransit.com/sites/default/files/marketing/website/pdf/2025NJ_TRANSIT_AnnualReportCombined_Final.pdf

the costs of climate resilience in infrastructure, sustaining New Jersey's climate resilience administrative infrastructure, and strengthening resilience in infrastructure investment.

Need for Investment, What's at Risk, and Worthwhile Sectors for Investment

The principal request from legislative committee leadership has been to ascertain the need for investment in storm resilient infrastructure, what is at risk from current and future storm or other climate-related damage, and what might be the most worthwhile investment of public funds to make New Jersey resilient to expected damage.

As noted, climate resilient infrastructure investment is that which will improve New Jersey's ability for social and ecological systems to absorb and adapt to stresses and shocks resulting from a changing climate, improving the State's ability to respond in the future. The data presented note the climate change challenges currently facing New Jersey, economic costs of recent weather and climate change events, and the vulnerabilities of New Jersey's infrastructure to climate change today and into the future.

To understand what infrastructure is at risk, we first defined infrastructure. We looked to physical infrastructure as well as non-physical systems rooted in the infrastructure sectors identified in the New Jersey State Development and Redevelopment Plan Infrastructure Needs Assessment and the FEMA Community Lifeline sectors that are noted as "critical infrastructure" as applied within the 2024 State Hazard Mitigation Plan (i.e., those that provide the most fundamental services in the community, that when stabilized, enable all other aspects of society to function).

To get a sense of what is at risk, we provided quantitative analyses of near-term and long-term flooding impacts to critical infrastructure under various climate scenarios demonstrating that coastal inundation poses a significant threat to a large number of properties, facilities, and roadways/bridges, while statewide flooding that includes inland areas shows an even larger proportion at risk. We noted qualitative impacts related to the increasing number of extreme heat days past and the strain extreme heat puts on infrastructure. We also reported a large number of properties and a significant value statewide are at Very High Exposure or greater of potential wildfire hazard, posing a threat to community and economic resilience in some areas. While a smaller number of critical facilities are at risk to wildfire exposure when compared to other climate hazards such as flooding, facilities such as those that contain or manage hazards materials are of specific concern due to the possibility of toxic chemicals being released into the atmosphere and threatening nearby communities.

Without considering resilience needs, the 2025 State Plan Infrastructure Needs Assessment finds the transportation sector in need of $65 billion through 2030; the energy

sector in need of $91- $194 billion over the next decade; and water supply $12 billion and wastewater treatment $11.75 billion over the next twenty years.

To better assess what might be the most worthwhile of investments, we reviewed a representative sample of fifteen climate change related regional and municipal planning and assessment documents prepared through the Resilient NJ program, the 2024 State Hazard Mitigation Plan, and several county hazard mitigation plans. This comparison across plans allowed us to determine what infrastructure sectors were most prevalently represented by mitigation project types, and impacts identified across the plans, as an indicator for the infrastructure sectors considered most at risk. We chose this content analysis approach given that these documents were prepared by recognized experts, included extensive public engagement, and are a broad representation of infrastructure impacts across New Jersey. Our review finds these sectors that stand out as defined in Table 1: Transportation, Water Resources and Flood Management; and Community, Education, and Cultural Infrastructure.

These sectors align with the conclusions made in *New Jersey's Economic Risks of Climate Change in New Jersey* report which as already noted finds the most pressing statewide economic threats driven by climate change to be: 1) residential and commercial property and insurance market impacts (including declining properties values in high-risk areas, increased mortgage default risk, rising insurance market costs for residential and commercial property owners, and rising housing costs) and 2) accelerating infrastructure vulnerabilities defined as deteriorating transportation assets (roads, bridges, rail lines), essential public health and safety infrastructure (electrical grids and stormwater, wastewater, and drinking water treatment facilities particularly in low-lying coastal communities), and gray (e.g., flood walls, levees, tide gates, pump stations) and green infrastructure (coastal dunes, living shorelines, bioretention systems) for flood protection.

As previously noted, our assessment did not find the electricity sector mitigation actions as prominent in the statewide HMP, county HMPs, regional and municipal resilience plans as the other sectors noted and where included, the actions were not about hardening the infrastructure as much as providing for individual homeowner back-up power or elevating electrical equipment out of flood areas. The lack of energy infrastructure measures may be because private companies are not beholden to carry out actions identified in these plans. Most New Jersey electricity customers are served by four private EDCs which must comply with BPU reliability practices, reporting, monitoring, and corrective measures. As noted, these EDCs can rate-base their resiliency measures under the BPU Infrastructure Investment Program for Utilities. BPU provides oversight of major event and annual reports and can require utilities to address reliability issues including penalties.

We conclude there is a clear case for investment in climate-resilient infrastructure in New Jersey with an emphasis on Transportation, Water Resources and Flood Management; and Community, Education, and Cultural Infrastructure sectors.

A review of investing in resilience, including resilience among these sector types, results in positive benefits when compared with costs including not only avoided losses, but also induced economic or development benefits, and additional social and environmental benefits.

Sustaining a Climate Resilience Framework for New Jersey

While New Jersey has a storied history of legislation and programs that address concerns about exposure to storms, erosion, and flooding dating back to at least the 1914 Waterfront Development Act, and there have been initiatives more recently to address climate change, there are important vulnerabilities to sustaining a climate resilience framework for New Jersey, particularly in light of the vast exposure of assets and communities to climate change identified above.[120]

Dedicated Climate Resilience Funding

We find that there is a need for, yet currently no dedicated sustained source of funding for climate resilient planning or infrastructure in New Jersey. Initiatives and projects are funded through a patchwork of federal and state resources, often centered on other goals (e.g., carbon sequestration, water quality, habitat restoration), yet not focused on maintaining a thriving business district, maintaining ratables or preventing damage before a climate related event such as a storm – all of which are at the center of local community asks and which impact affordability. We also note that Federal sources of funds are no longer as reliable as they once were.

For example, while the Resilient NJ Program has resulted in more than $31 million in awards to implement climate action plans, these are supported by multiple grants and funding sources such as FEMA's BRIC program, National Fish and Wildlife Coastal Resilience Fund, National Oceanic and Atmospheric Administration, U.S. Department of Housing and Urban Development, and NJDEP's Natural Climate Solutions grants.[121] [122]

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[120] Bulger, G., M. Kaplan, Andrews, C. and G. Rivera. (2026). Historical Timelines of Climate Change Mitigation and Adaptation Policy in New Jersey: 2026 Update. Rutgers, The State University of New Jersey. DOI: https://doi.org/10.7282/00000631

[121] New Jersey Department of Environmental Protection. 2025. National Fish and Wildlife Foundation grants bring federal funding for Resilient NJ Program to $26.5 million since 2021. Available at https://dep.nj.gov/newsrel/25_006/

[122] New Jersey Department of Environmental Protection. 2026. Sherrill administration marks Earth week by delivering on mission to address flooding. Available at https://dep.nj.gov/newsrel/26_0015/

As noted previously, the New Jersey Water Bank supports infrastructure financing for many types of water resilience related programs (e.g., wastewater treatment, safe drinking water, stormwater management, combined sewer overflows, and stormwater utility feasibility studies) through a combination of federal funded state revolving loan programs that are matched by state appropriations (bond acts or direct state aid), and additional federal funds (e.g., the Bipartisan Infrastructure Law (BIL) of 2024 and the American Rescue Plan Act (ARPA) of 2021).[123] [124] [125] [126] [127] Important to note is that the federal Clean Water and Drinking Water State Revolving Funds (SRFs), which provide continuous infrastructure investments replenished through loan repayments into the future, are in peril on two counts: 1) they are being diverted to fund one-time grants made via Congressionally Directed Spending (i.e., "earmarks") that had historically been funded through a separate appropriation and 2) the US Environmental Protection Agency has proposed an 85% reduction to SRF funds in its FY27 budget request.[128] [129] [130] [131] [132] Further, the BIL and ARPA infrastructure funds will be spent out by December 31, 2026. [133] [134] However, the New Jersey Transportation Bank provides precedent for a New Jersey

[123] New Jersey I-Bank. n.d. New Jersey Water Bank. https://www.njib.gov/njeit accessed 8 August 2026.
[124] New Jersey Water Bank. n.d. The New Jersey Water Bank. The Partnership: The New Jersey Water Bank. https://dep.nj.gov/wiip/njwb-process/about-us/ accessed 8 August 2026.
[125] New Jersey Department of Environmental Protection. n.d. New Jersey Water Bank (NJWB) Program. https://dep.nj.gov/grantandloanprograms/new-jersey-water-bank-njwb-program/ accessed 8 August 2026.
[126] New Jersey Department of Environmental Protection. n.d. NJ Water Bank Sewer Overflow and Stormwater Reuse Municipal Grants. https://dep.nj.gov/grantandloanprograms/new-jersey-water-bank-the-sewer-overflow-and-stormwater-reuse-municipal-grants/ accessed 8 August 2026.
[127] New Jersey Department of Environmental Protection. n.d. Stormwater Competitive Grants and Resilience/Stormwater Utility Feasibility Technical Assistance Grants https://dep.nj.gov/grantandloanprograms/stormwater-competitive-grants-and-resilience-stormwater-utility-feasibility-technical-assistance-grants/ accessed 8 August 2026.
[128] Schmidt, D. 2026. How Congressional Earmarks are Draining America's Water Funds. Water Finance and Management. Available at https://waterfm.com/how-earmarks-draining-americas-water-funds/
[129] Duyshart, C.M. 2026. Increase Funding for the Clean Water and Drinking Water State Revolving Fund (SRF) Programs. National Association of Counties. Available at https://www.naco.org/resource/increase-funding-clean-water-and-drinking-water-state-revolving-fund-srf-programs
[130] National Governors Association. 2024.The Unintended Impact of Congressionally Directed Spending on State Revolving Funds. Available at https://www.nga.org/wp-content/uploads/2024/04/SRF-One-Pager-4.8.24.pdf
[131] McGuire, M. 2025. Experts weigh up possible White House impacts on Delaware River watershed. NJ Spotlight News. Available at https://www.njspotlightnews.org/2025/04/how-trump-administration-actions-could-impact-delaware-river-watershed/
[132] Magill, B. 2026. US Water Attacks Spur EPA to Recommend Fund It Seeks to Cut. Bloomberg Law. Environment & Energy. Available at https://news.bloomberglaw.com/environment-and-energy/water-systems-worried-over-hacks-directed-to-funds-epa-wants-cut
[133] 31 CFR § 35.5
[134] Moreno, D. 2025. 2024. FAQs: Navigating the ARPA SLRF Obligation Deadline. National League of Cities. Available at https://www.nlc.org/article/2024/12/06/faqs-navigating-the-arpa-slfrf-obligation-deadline/

revolving loan infrastructure financing program that does not rely on federal funds and is supported through state bond legislation which authorizes the New Jersey Transportation Trust Fund.[135]

Other States have successfully implemented dedicated funding for resilient infrastructure initiatives. For example, New York State voters passed a $4.2 billion Clean Water, Clean Air and Green Environmental Bond Act in 2022 with 67.5% voter approval.[136] The Bond Act has several provisions including funds that align with the infrastructure sectors we have identified in our analysis: Restoration and Flood Risk Reductions (not less than 26% of funds); Water Quality Improvement and Resilient Infrastructure (not less than 15% of funds); Open Space Conservation and Recreation (up to 15% of funds); as well as funds for Climate Change Mitigation (up to 35% of fund for greenhouse gas emissions reduction).[137] The Act advances environmental justice through directing at least 35% with a goal of 40% of total funding towards disadvantaged communities.[138]

In 2025 the Resilient Rhody Infrastructure Fund law also provided authority to establish a dedicated state revolving fund within the Rhode Island Infrastructure Bank to support local climate resiliency and stormwater projects, building on the state's Municipal Resilience Program.[139] [140] [141]

Diversifying Funding Strategies For Infrastructure Resilience

Public vehicles to finance infrastructure investment can be augmented and leveraged through partnerships with foundations and the private sector**.** For example, The Robert W. Johnson Foundation is providing a $3 million loan guarantee to fund predevelopment engineering design and technical services (including assistance with applications to the NJ

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[135] New Jersey Infrastructure Bank and New Jersey Department of Transportation. 2026. New Jersey Transportation Infrastructure Financing Program. State Fiscal Year 2027 Financial Plan. Available at https://cdn.njib.gov/njtib/publications/2026-5/SFY2027-Transportation-Bank-Fin-Plan-May-Report.pdf

[136] New York Proposal 1 Election Results: Issue Climate Change Bonds. (2022, November 18). *New York Times*. https://www.nytimes.com/interactive/2022/11/08/us/elections/results-new-york-proposal-1-issue-climate-change-bonds.html

[137] New York State. n.d. Environmental Bond Act. Funding Overview. https://environmentalbondact.ny.gov/ accessed 8 August 2026.

[138] New York State. n.d.Environmental Bond Act. Program Priorities. https://environmentalbondact.ny.gov/pages/priorities accessed 8 August 2026.

[139] R.I. Gen. Laws § 46-12.2-4.4

[140] State of Rhode Island General Assembly. 2025. Sponsors join General Treasurer and state leaders to celebrate Resilient Rhody Infrastructure Law. Available at https://rilegislature.gov/pressrelease/_layouts/RIL.PressRelease.ListStructure/Forms/DisplayForm.aspx?List=c8baae31%2D3c10%2D431c%2D8dcd%2D9dbbe21ce3e9&ID=375915&Web=2bab1515%2D0dcc%2D4176%2Da2f8%2D8d4beebdf488

[141] Rhode Island Infrastructure Bank. 2025. Annual Report. Available at https://www.riib.org/wp-content/uploads/2026/03/2025-Annual-Report-Corrected.pdf

Water Bank) for municipalities to accelerate replacement of lead service lines.[142] While not a climate resiliency infrastructure project per se, this is a tangible example of a New Jersey public-philanthropic-private infrastructure partnership. Water quality improvements for stormwater and sanitary sewer infrastructure necessary for The Crossings at Brick Church Station, a mixed-use transit-oriented redevelopment project, are being financed through a partnership between the New Jersey Water Bank and the City of East Orange.[143] In January 2026, New Jersey's Social Impact Investment Fund (SIIF) was announced to expand access to projects that advance social equity in New Jersey, including financing access to capital for early-stage affordable housing developers and infrastructure investments in distressed municipalities to modernize drinking water systems; the SIFF could be a vehicle to help finance projects that consider and meet a climate resilient infrastructure need.[144]

Accounting for the Costs of Climate Resilience in Infrastructure

For long-term planning, it is important to have a fuller understanding of the state's infrastructure needs that accounts for climate resilience, but that should not be an impediment to moving forward today.

As noted above, the current New Jersey INA did not account for the full costs of climate resilience, yet identified the tremendous needs that New Jersey has for funding infrastructure. In the meantime, there are multiple New Jersey state-based climate resilience initiatives underway (with some highlighted in this report) that have and continue to identify important infrastructure-related actions that can move forward while a more in-depth analysis of climate-resilient infrastructure costs is developed.

Other states have developed comprehensive approaches to evaluating resilience funding needs that can be instructive for New Jersey. Rhode Island is one case in point. Through two state laws, the *Resilient Rhode Island Act* in 2014 and the 2024 *Act on Coasts*, Rhode Island has prepared two Resilient Rhody Plans (2018 and 2025) which identify priority climate resilience actions and in 2025, includes a statewide vulnerability assessment, prioritization of actions that address critical infrastructure including a cost estimate of each solution, and a funding solution strategy that includes a framework to help state and

[142] New Jersey Department of Environmental Protection. 2025. NJDEP, Robert Wood Johnson Foundation and Arcadis Commence Lead Poisoning Prevent Week By Launching Collaboration to Accelerate Lead Pipe Replacements. Available at https://dep.nj.gov/newsrel/25_0046/

[143] New Jersey Infrastructure Bank. 2023. East Orange City Crossings at Brick Church Loan. Available at https://www.njib.gov/news/east-orange-city-crossings-at-brick-church-loan

[144] State of New Jersey Department of the Treasury. 2026. Treasury Announces Selection of Fund Manager for Social Impact Investment Fund. Available at https://www.nj.gov/treasury/news/2026/01202026.shtml

local partners identify and prioritize projects, navigate funding opportunities, and coordination implementation.[145]

Pursuant to state legislation in 2024, Minnesota Pollution Control Agency conducted an analysis of the projected costs in Minnesota of climate change adaptation and resilience measures needed to mitigate projected climate impacts under at least two future climate scenarios.[146] The study found these costs to be an additional investment of $2.5 to $4.1 billion annually on average from 2040 to 2099; while the impacts of climate change without further investment would be $17 to $22 billion annually by mid-century (2040-2059) and increase to $36 to $57 billion annually by end of century (2070-2099).[147]

The *ResilientMass Finance Strategy* is a comprehensive roadmap for investing in climate resilience enabling Massachusetts understand infrastructure protection options, investment needs and costs of key resilience measures, and how to build a long-term system to finance projects faster.[148] Key resilience measures center on small bridges and culverts; significant high hazard dams; forest conservation and tree planting; coastal and riverine wetlands and floodplains; strategic transportation infrastructure; drinking water, wastewater, and stormwater infrastructure; and heat preparedness and relief.[149] Rough order of magnitude estimated costs were $90 billion to $130 billion through 2050.[150] The plan links to Governor Healy's 2025 proposed Resilience Revolving Fund in the Mass Ready Act; versions of the legislation are currently in the reconciliation stage within the legislature.[151] [152]

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[145] Rhode Island Department of Environmental Management and Rhode Island Infrastructure Bank. 2025. Resilient Rhody 2025. Available at https://climatechange.ri.gov/resilient-rhody-2025

[146] 2024 Session Laws, Chapter 116, Article 2, Section 33. Available at https://www.revisor.mn.gov/laws/2024/0/Session+Law/Chapter/116/#laws.2.33.0

[147] Industrial Economics, University of Minnesota Climate Adaptation Partnership, Consensus Building Institute, and Two Degrees Adapt. 2026. Minnesota Climate Adaptation and Resilience Cost Study (Document No. lrcc-mn-1sy26) Minnesota Pollution Control Agency. https://www.pca.state.mn.us/sites/default/files/lrcc-mn-1sy26.pdf

[148] Commonwealth of Massachusetts. n.d. ResilientMass Finance Strategy. https://www.mass.gov/info-details/resilientmass-finance-strategy#read-the-report accessed 8 August 2026.

[149]Commonwealth of Massachusetts. 2025. ResilientMass Finance Strategy Full Report. Available at https://www.mass.gov/doc/resilientmass-finance-strategy-report/download

[150] Commonwealth of Massachusetts. 2025. ResilientMass Finance Strategy Full Report. Available at https://www.mass.gov/doc/resilientmass-finance-strategy-report/download

[151] Commonwealth of Massachusetts. 2025. ResilientMass Finance Strategy Full Report. Available at https://www.mass.gov/doc/resilientmass-finance-strategy-report/download

[152] Ahlberg, J. 2026. 2026. House passes $3.5B environmental bond bill. Massachusetts Municipal Association. Available at https://www.mma.org/house-passes-its-version-of-3-5b-environmental-bond-bill/

Sustaining New Jersey's Climate Resilience Administrative Infrastructure and Framework

Given the vulnerability to climate change that New Jersey faces, the State can consider mitigating its own vulnerability to addressing this issue into the future through legislative authority to sustain an administrative infrastructure and framework commensurate with the goals of EO 89. It might also consider the role of advisors to, or non-state agency representation on, its Interagency Council.

In 2019, Executive Order (EO) 89 created: a Chief Resilience Officer (CRO); a Climate and Flood Resilience Program under the direction of the CRO; and an Interagency Council on Climate Resilience to coordinate efforts across state government, support the CRO in developing and implementing a Statewide Climate Change Resilience Strategy that is to also include a Coastal Resilience Plan. The CRO and the Interagency Council have authority to: call upon assistance from any State Agency to carry out the EO directives and also to consult with scientific experts at academic and research institutions in developing a Scientific Report on Climate Change (also under the purview of the CRO) and the aforementioned Statewide Climate Change Resilience Strategy. The EO also requires the State Planning Commission to incorporate climate change considerations based on the Scientific Report and the Statewide Strategy as a mandatory requirement for State Plan endorsement. [153]

For example, states such as Colorado,[154] Florida,[155] Louisiana,[156] Maryland,[157] South Carolina,[158] and Virginia,[159] have statutorily-created CRO or positions inclusive of CRO functions (Climate Chief or Director of Resiliency) providing for long-term stability, durability, and resources with their focus on pre-disaster planning and long-term resilience rather than immediate disaster response.[160] Further, Saks (2025) notes that while California does not have a CRO titled position, its Integrated Climate Adaptation and

[153] Murphy, P. (2019, October 29). Executive Order No. 89. State of New Jersey. Available at https://nj.gov/infobank/eo/056murphy/pdf/EO-89.pdf
[154] Colo. Rev. Stat. § 24-32-121
[155] Fl. Laws § 14.2031(1) available at https://www.flsenate.gov/Laws/Statutes/2024/0014.2031
[156] La. Stat. Ann. § 49:220.41 available at https://www.legis.la.gov/legis/Law.aspx?d=1337940
[157] Md. Code Ann., Pub. Safety § 14-1201
[158] S.C. Code Ann. § 48-62-20(C) available at https://www.scstatehouse.gov/sess123_2019-2020/bills/259.htm
[159] Va. Code Ann. § 2.2-220.5 available at https://law.lis.virginia.gov/vacode/title2.2/partA/section2.2-220.5/
[160] Saks, J. 2025. State Chief Resilience Officers: Establishment, Authority & Governance. Georgetown Climate Center. https://www.georgetownclimate.org/files/report/STATE_CHIEF_RESILIENCE_OFFICERS_GCC_FINAL_REPORT.pdf

Resiliency Program is created by statute and fulfills equivalent CRO functions as in other states.[161] [162]

As noted, EO89 created New Jersey's Interagency Council on Climate Resilience to coordinate efforts of Executive Branch departments and agencies and provides the authority for the Governor to appoint additional members beyond those noted in the EO. However, we note that other states do provide comprehensive statutory authority for advisory bodies that also include representation beyond state agencies with stakeholder and outside expert advisors.

Rhode Island's legislation in 2014 and 2024 created an Executive Climate Change Coordinating Committee (EC4) of state level agencies to integrate, and coordinate climate change efforts throughout state agencies to both reduce emissions and strengthen communities and infrastructure resilience prepare for climate change effects and coordinate vulnerability assessments throughout state government.[163] The EC4 is required to issue an annual report on its finding, recommendations, and progress.[164]

The law also creates two advisory bodies: an EC4 Advisory Board and an EC4 Science and Technical Advisory Board (STAB). The EC4 Advisory Board is among other things charged with producing an annual report and includes municipal government representatives, and experts in economic policy, workforce development, natural and cultural resources management, energy planning, engineering and design, education, public health and safety, housing or organizations representing/serving youth or the elderly.[165] [166] The STAB includes members from higher education institutions in the state, research laboratories in the state, state agency members with climate change expertise and responsibilities, and a

[161] Saks, J. 2025. State Chief Resilience Officers: Establishment, Authority & Governance. Georgetown Climate Center. https://www.georgetownclimate.org/files/report/STATE_CHIEF_RESILIENCE_OFFICERS_GCC_FINAL_REPORT.pdf

[162] California Code, Public Resources Code-PRC § 71354 available at https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=71354.&lawCode=PRC

[163] R.I. Gen. Laws § 42-6.2-2.

[164] R.I. Gen. Laws § 42-6.2-7.

[165] R.I. Gen. Laws § 42-6.2-4,

[166] State of Rhode Island. n.d. Governor's Climate Priorities. EC4 Advisory Board. https://climatechange.ri.gov/ri-executive-climate-change-coordinating-council-ec4/advisory-board accessed 8 August 2026.

member from the Rhode Island Department of Health and among other duties the STAB is to prepare an annual report.[167] [168]

Maryland's Commission on Climate Change (MCCC) was established in 2015 through state legislation to advise the Governor and General Assembly on "ways to mitigate the causes of, prepare for, and adapt to the consequences of climate change."[169] The statute requires the Commission to provide an Annual report to the Executive Branch and the General Assembly.[170] The MCCC includes representation from not only state agencies, but also the legislature, local government, business, environmental nongovernmental organizations, organized labor, philanthropic interests, and the State University system.[171] There are various working groups, including an Adaptation and Resiliency Working Group.[172]

The statutorily created California Integrated Adaptation and Resiliency Program, includes a Technical Advisory Council from a range of disciplines to provide scientific and technical support, and from regional and local governments and entities including but not limited to public health, environmental quality, environmental justice, agriculture, transportation and housing , energy, natural resources and water, planning, recycling and waste management, local or regional government, tribal issues, emergency service and public safety.[173]

Strengthening Resilience In Infrastructure Investment

As noted in the New Jersey State Development and Redevelopment Plan Impact Assessment, New Jersey is on the front line of climate vulnerability, major climate impacts are now evident realities of all New Jerseyans, and sound planning is essential to foster resilience and protect life and property across the state, especially where flood hazard

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[167] State of Rhode Island. n.d. Governor's Climate Priorities. EC4 Science & Technical Advisory Board (STAB). https://climatechange.ri.gov/ri-executive-climate-change-coordinating-council-ec4/science-technical-advisory-board-stab accessed 8 August 2026.
[168] R.I. Gen. Laws § 42-6.2-5.
[169] Maryland Climate Change Commission Act, 2015 Md. Laws ch. 429.
[170] Maryland Department of the Environment. n.d. Maryland Commission on Climate Change Annual Reports. https://mde.maryland.gov/programs/air/ClimateChange/MCCC/Pages/MCCCReports.aspx accessed 8 August 2026.
[171] Maryland Department of the Environment. n.d. Maryland Commission on Climate Change. https://mde.maryland.gov/programs/air/ClimateChange/MCCC/Pages/index.aspx
[172] Maryland Department of the Environment. n.d. Adaptation and Resiliency Working Group. https://mde.maryland.gov/programs/air/ClimateChange/MCCC/Pages/ARWG.aspx accessed 8 August 2026.
[173] California Code, Public Resources Code-PRC § 71358 available at https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=71358.&nodeTreePath=70.14&lawCode=PRC

areas will become increasingly at risk.[174] In evaluating the strategies in the State Plan for strengthening New Jersey's climate resilience, it is noted that there is high evidence in the planning literature to support strategies to: adapt infrastructure to contend with climate change, especially impacts that disproportionately affect vulnerable populations, to strictly limit development in floodplains, and to implement mandatory flood mitigation standards in new construction and restrict development in high risk zones.[175] Infrastructure investments can be coupled to conditions to ensure they are resilient to climate change hazards by limiting their development in high risk areas (for example, areas prone to flooding, storm surge, or inundated by sea level rise over their lifetime); providing design guidelines that account for climate risk; and encouraging investments that will direct residences and businesses to low-risk areas.

For example, borrowers for infrastructure project funds through the New Jersey Water Bank as well as the NJ Infrastructure Bank Community Hazard and Mitigation Assessment Program (CHAMP) must agree to maintain the project in good repair and make all necessary repairs and improvements to the project to ensure its resiliency and operation to address climate change impacts for the life of loan (20 years); project covenants also direct the borrower to the NJDEP *Building Resilience Water Infrastructure Climate Change Resilience Guidance*.[176] [177] [178][179]

The Port Authority of NY and NJ has developed Climate Resilience Guidelines to mitigate climate change impacts on its facilities and infrastructure to maximize long-term safety and operations of its airports, bridges and tunnels, rail stations, and seaports.[180]

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[174] Rowan University and Rutgers University. 2025. Impact Assessment of the 2024 New Jersey State Development and Redevelopment Plan. Prepared for the New Jersey State Planning Commission and the New Jersey Office of Planning Advocacy. Available at https://www.nj.gov/state/bac/planning/state-plan/assessment/

[175] Rowan University and Rutgers University. 2025. Impact Assessment of the 2024 New Jersey State Development and Redevelopment Plan. Prepared for the New Jersey State Planning Commission and the New Jersey Office of Planning Advocacy. Available at https://www.nj.gov/state/bac/planning/state-plan/assessment/

[176] New Jersey Department of Environmental Protection. n.d. Building Resilient Water Infrastructure. https://dep.nj.gov/wiip/resilience/ accessed 9 August 2026.

[177] New Jersey Department of Environmental Protection. 2023. Building Resilience Water Infrastructure Climate Change Resilience Guidance. Available at https://dep.nj.gov/wp-content/uploads/wiip/building-resilient-water-infrastructure-climate-change-resilience-guidance.pdf

[178] New Jersey Resilience Infrastructure Bank. 2023. NJ CHAMP Program. Available at https://www.njib.gov/news/nj-champ-program

[179] New Jersey Infrastructure Bank. 2024. Resolution 24-47: Authorization of SFY2025 CHAMP Direct Loans. Available at https://cdn.njib.gov/njib/governance/board-resolutions/2024/Resolution%20No%2024-47%20SFY2025%20Authorizing%20CHAMP%20Direct%20Loans%20Resolution.pdf

[180] Port Authority of NY NJ. n.d. Climate Resilience. https://www.panynj.gov/port-authority/en/about/Environmental-Initiatives/climate-resilience.html accessed 9 August 2026.

NJDEP's Inland Flood Protection Rule and Resilient Environments and Landscapes (REAL) rules work together to make New Jersey's infrastructure, more resilient to the increasing risks of flooding and climate change and provide more protection than the guidances cited above. The Inland Flood Protection Rule, adopted in 2023, addresses riverine flooding by using climate-informed precipitation data to better define future flood hazards and requiring new or reconstructed assets in those areas—including roads, bridges, drainage systems, utilities, and other public facilities—to be designed for heavier rainfall and worsening flood conditions rather than relying solely on historical data.[181] REAL complements this approach by addressing coastal flooding, sea-level rise, storm surge, chronic inundation, and stormwater, including requirements intended to ensure that new and redeveloped infrastructure is designed for conditions expected over its useful life. Among other measures, REAL adjusts coastal flood elevations to account for projected sea-level rise, establishes an Inundation Risk Zone for critical infrastructure, provides for higher roadways or other flood-resilient design where applicable, and strengthens stormwater management and nature-based approaches.[182] Together, the two initiatives shift infrastructure planning from reacting to past flooding toward anticipating future climate conditions, helping reduce damage and service disruptions, maintain transportation and utility networks during extreme events, protect emergency access, and avoid repeated public expenditures to repair infrastructure that was not designed for the conditions it will face over its lifespan.

[181] New Jersey Department of Environmental Protection. 2023. Inland Flood Protection Rule. Available at https://dep.nj.gov/inland-flood-protection-rule/

[182] New Jersey Department of Environmental Protection. 2026. Resilient Environments and Landscapes. Available at https://dep.nj.gov/njreal/

Appendix
Rutgers Flood Resilience Lab

Team Overview

At Rutgers Flood Resilience lab, we are a team of senior researchers and applied scientists who together cover the full chain of climate-driven physical risk analysis, from atmospheric and hydrologic hazard to high-resolution exposure of buildings and infrastructure, to operational forecasting and decision-support. We bridge advanced science, data-driven modeling, and the practical realities of public-sector decision making.

We lead internationally recognized programs at the intersection of climate, water, and the built environment, with active funding from NSF, NASA, FEMA, the World Meteorological Organization, and state agencies. Collectively, we have delivered operational systems and analytical products for sovereign agencies and transportation authorities across North America, the Caribbean, Sub-Saharan Africa, and we are positioned to extend the same capabilities to private-sector clients.

Our complementary expertise allows the team to move seamlessly from physical hazard quantification to asset-level exposure and vulnerability assessment, to translation into actionable intelligence for planning and emergency response. The team is well positioned to support the climate-risk and resilience priorities of municipalities, state government, and multilateral institutions.

What We Deliver

Climate and physical risk analytics. Quantitative, location-specific assessments of flood, drought, extreme rainfall, debris-flow, post-fire, and compound hazards under current and future climate conditions. These outputs can support investment screening, portfolio risk assessment, infrastructure due diligence, and climate-risk reporting to investors, lenders, and regulators.

Exposure and asset-level intelligence. High-resolution characterization of buildings, transport assets, utilities, and critical infrastructure using mobile LiDAR, computer vision, and AI-assisted feature extraction. We can deliver elevation-certificate-grade data, asset inventories, and digital twins at neighborhood-to-city scale at a fraction of the cost of traditional surveying.

Operational forecasting and early warning. Design and deployment of end-to-end early warning systems for riverine, pluvial and compound flooding. Our systems integrate radar, satellite, numerical weather prediction, hydrologic models, and machine learning, and have been operationalized at city, state, and national scale.

Decision-support. Co-designed tools that connect forecasts and risk metrics to concrete actions for emergency managers, infrastructure operators, and development actors. We have direct experience with anticipatory action protocols and loss-modeling frameworks used by public insurance programs.

Capacity building and stakeholder engagement. Training, knowledge transfer, and co-production with national hydromet services, sub-national governments, and community-based organizations, with established working relationships with the World Meteorological Organization and counterpart agencies in multiple regions.

An Integrated Capability Chain

Most providers cover one segment of climate-risk work; our combined skill set covers the full pipeline, end to end.

Hazard	Exposure	Forecasting & EWS	Decision Making & Outreach
Climate, hydrology, extreme rainfall, drought, flood, debris flow, post-fire, compound events	Buildings, infrastructure, transport assets, utilities; LiDAR, computer vision, digital twins	Riverine, pluvial, coastal; radar/satellite/NWP integration, ML nowcasting, operational systems	Loss modeling, anticipatory action, climate-risk analytics, and public communication

Core Team Members for this Proposed Project

Jie Gong, Ph.D.

Professor, Rutgers University · Co-Director, Flood Resilience Lab · Director, Rutgers Urban Informatics Lab

Core expertise. Urban informatics, terrestrial and mobile LiDAR, computer vision and AI for the built environment, building and infrastructure exposure characterization, digital twins, flood-risk visualization, resilient design of buildings and transportation systems.

Selected applied work. Principal investigator on FEMA/NJOEM-funded LiDAR mapping and AI-based building characterization across the New Jersey 500-year flood plain; PI on the NJ TRANSIT Storm Surge Warning System and the operational Hoboken Terminal Early Flood Warning System, in continuous use by the agency; PI on the Elizabeth Flood Early Warning System with a coupled coastal-riverine-sewer modeling framework and city-scale digital twin; lead developer of CLEAR, a proprietary AI-enabled platform that produces elevation-certificate-grade structural data at over 90% cost savings versus traditional surveys; co-developer of Generative Flood Vision, a diffusion-model-based, engineering-grade flood visualization platform; co-lead of the Exposure Team on the NSF Megalopolitan Coastal Transformation Hub (MACH).

Funding and recognition. Sustained funding from NSF, FEMA, DHS, USHUD, New Jersey Transit, and the Port Authority of New York and New Jersey; faculty advisor to the New Jersey Climate Change Resource Center; invited to testify before the U.S. House Science and Technology Committee on flood resilience; recognized with the ASCE Educator of the Year and Outstanding Engineering Faculty awards.

Efthymios I. Nikolopoulos, Ph.D.

Associate Professor, Rutgers University · Director, Hydrology and Remote Sensing Lab · Co-Director, Flood Resilience Lab

Core expertise. Hydrology and hydrologic modeling, flood forecasting, extreme rainfall and flood frequency analysis, satellite and radar precipitation, climate downscaling, drought and ecohydrology, debris-flow and post-fire hazards, machine learning for hydrologic prediction.

Selected applied work. Co-PI on the Florida Public Flood Loss Model and the Florida Public Hurricane Loss Model, used by the state insurance regulator; PI on NASA-funded machine-learning flash-flood forecasting in West Africa; PI on NASA-funded mapping of hydroclimatic risk in High Mountain Asia; PI on a separate Aga Khan Agency for Habitat–funded assessment of future climate risk for communities in Afghanistan, Pakistan, and Tajikistan; co-PI on the FEMA-funded New Jersey Flood Intelligence Network for Emergencies; co-PI on a World Meteorological Organization–funded project on urban flood early warning systems in the Caribbean and Comoros.

Funding and recognition. External research funding from NASA, NOAA, NSF, FEMA, USAID, and FOIR; Associate Editor for the Journal of Hydrology; invited speaker at Google's Flood Forecasting Workshops; Marie Skłodowska-Curie Fellow.

Sample Projects

Project Name: Terrestrial LiDAR Mapping and Analysis of Buildings and Infrastructures within the New Jersey 500-Year Flood Plain

From Pixels to Policy: LiDAR Mapping & AI for Automated Lowest Floor Elevation Estimation

Sponsoring Organization: Federal Emergency Management Agency (FEMA)/New Jersey Office of Emergency Management

Project Duration: 2022-2024

Project Description: The elevation of the lowest living floor (LFE) in residential buildings is the most critical variable in determining flood risk ratings across the United States. Despite its importance, this data is currently unavailable for the vast majority of homes located within designated floodplains. To address this gap, this project explores the use of mobile LiDAR (Light Detection and Ranging) technology to derive precise LFE data for all structures situated within the 100-year and 500-year floodplains in the state of New Jersey. By leveraging advanced remote sensing and geospatial analytics, the project aims to support data-driven decision-making for flood risk assessment and resilience planning.

Outputs: The project successfully deployed state-scale mobile LiDAR systems—commonly used in city-scale 3D mapping—for high-speed, high-accuracy data collection across New Jersey's flood-prone areas. One of the core challenges addressed was the efficient processing of massive volumes of LiDAR point cloud data to extract reliable LFE values for tens of thousands of buildings.

To overcome this, the team developed an end-to-end, AI-enhanced software platform capable of processing mobile LiDAR data at scale. This system integrates:

- A 3D building elevation modeling engine,
- A machine learning model trained to detect and extract LFE from LiDAR datasets with high precision,
- A cloud-based data management platform that enables collaborative workflows for data extraction, validation, and updates.

The integration of these components results in a streamlined, automated pipeline for generating and managing large-scale LFE datasets.

Outcomes: The project resulted in the most comprehensive and accurate lowest floor elevation dataset ever produced in the United States, covering the entire building stock within New Jersey's 100-year and 500-year floodplains. By combining remote sensing, AI, and cloud computing technologies, the project has set a new standard for flood risk data infrastructure. This LFE dataset represents a major advancement

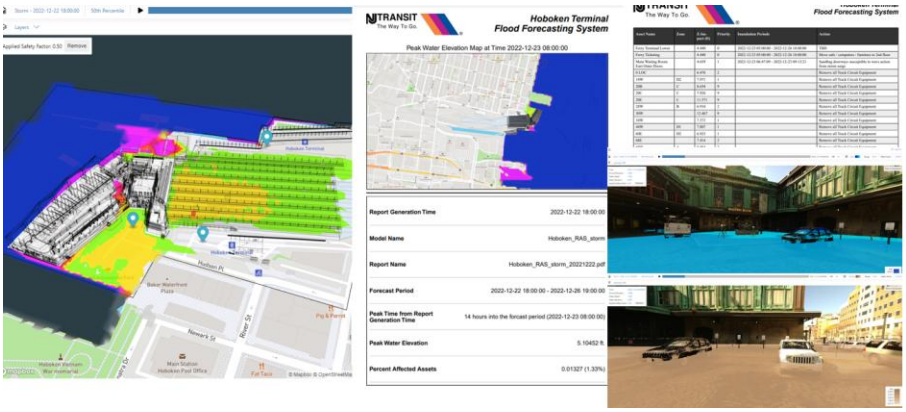
for flood resilience efforts in New Jersey, enabling improved flood insurance modeling, emergency preparedness, infrastructure planning, and climate adaptation strategies. Moreover, the methodologies and technologies developed through this project have strong potential for replication in other states, offering a scalable solution to a nationwide data gap in flood risk assessment.

Project Name: Early Flood Warning Systems

Sponsoring Organization: Federal Emergency Management Agency (FEMA)/New Jersey Office of Emergency Management, New Jersey Transit

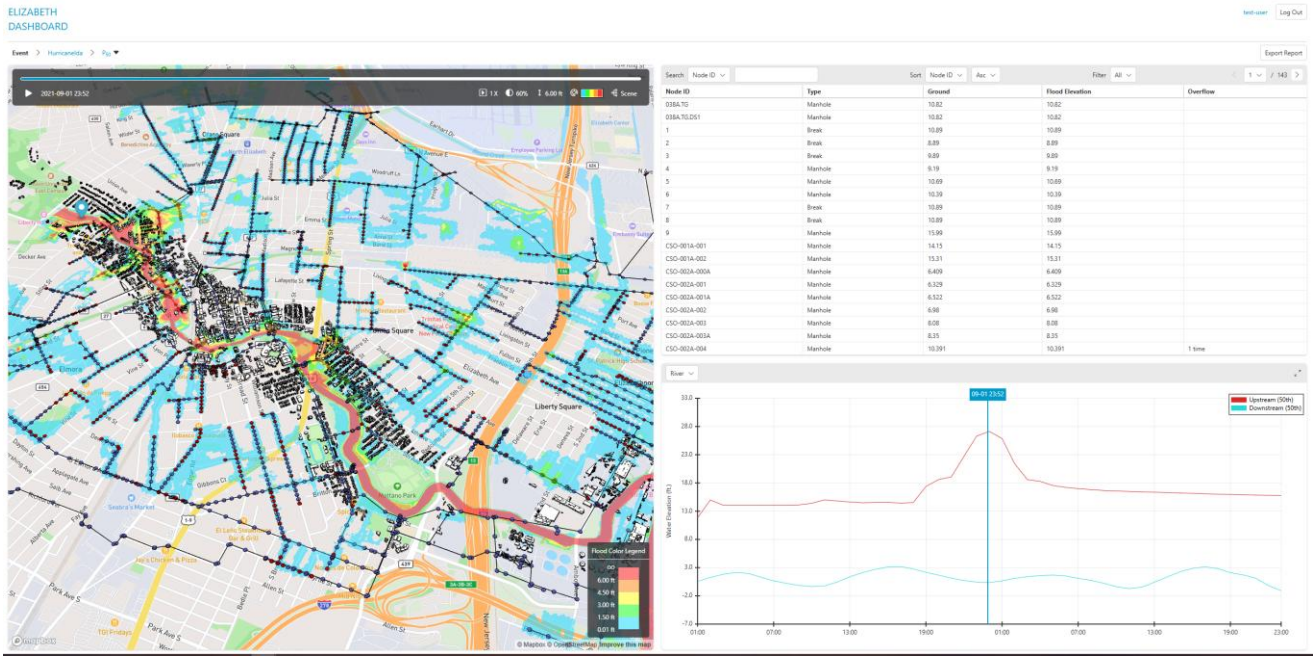
Flood early warning systems can play a crucial role in mitigating impacts to flood prone communities, but only if they deliver accurate and timely information on three key aspects: (1) the nature of the flood hazards, (2) who and what are at risk, and (3) the potential consequences. At Urban Reality, we has built advanced, city-scale flood Early Warning Systems (EWS) to protect vulnerable communities and critical infrastructure.

The Hoboken Terminal Early Flood Warning System forecasts coastal storm surge impacts to this historic and increasingly vulnerable transportation hub. A full-scale, high-fidelity 3D model of the entire terminal was developed, encompassing hundreds of individual assets within the rail infrastructure (Figure 7). The system provides not only flood forecasts but also dynamic visualizations of potential flood scenarios and decision-support tools for mitigation planning. Operational for over two years, the system has been actively utilized by NJ Transit to inform daily operations and enhance resilience planning.



Early Flood Warning System for NJ Transit Hoboken Terminal

Another example Early Warning System currently we developed is Elizabeth Flood Early Warning system (Figure 8). This system features a city-scale digital twin and incorporates an innovative coupled modeling framework. The approach integrates coastal surge, riverine flooding, and combined sewer overflows (CSOs) from the entire municipal sewer network, enabling comprehensive flood forecasting and infrastructure impact assessment across multiple hydrologic domains.



Early Flood Warning System for the City of Elizabeth

Project Name: CITADEL – A Hazard Mitigation Planning and Disaster Preparedness Collaboratory in New Jersey

Sponsoring Organization: Federal Emergency Management Agency (FEMA)/New Jersey Office of Emergency Management

Project Duration: 2023-2026

Flood risk in New Jersey is accelerating. Per the NJ Climate Resource Center, buildings worth $197 billion already lie within FEMA's 100- and 500-year flood zones—a figure that will grow once urban flash flooding is fully accounted for. Meeting this challenge requires knowing what is happening on the ground before, during, and after a storm. Emerging technologies now make that possible: satellite imagery, airborne and mobile lidar, and street-level imagery reconstruct high-fidelity urban and elevation models, and distributed sensors and community observations stream real-time awareness onto them, all fused by wireless, cloud, and edge computing—ushering in a new era of digitized disaster management. These capabilities enable city-scale digital twins: virtual replicas of coastal communities that model hazards, analyze exposure and vulnerability, and communicate climate risk. Agencies can use them to reduce infrastructure vulnerabilities, while residents can personalize their risk and make informed decisions during storm events.

Building on these advances in remote sensing, AI, and hydrological science, Rutgers Flood Resilience Lab built a multi-scale digital twin for New Jersey. It is composed of component digital twins at the facility, city, and state scales, each coupling flood hazard, high-fidelity urban, and impact models, with coarser scales passing boundary and forcing conditions downward to refine finer ones—all orchestrated by AI-powered workflows triggered by sensors and stakeholder needs. This twin has been used to support New Jersey's disaster management functions—including early flood warning, now-cast, post-cast, and risk communication. In particular, it was used to support New Jersey’s flood mitigation efforts in flood events such as July 14 2025 North Plainfield and this year’s July rain storm events. The work has demonstrated improvements over traditional state hazard mitigation approaches and highlight the trade-offs among model resolution, accuracy, and utility that shape operational deployment.